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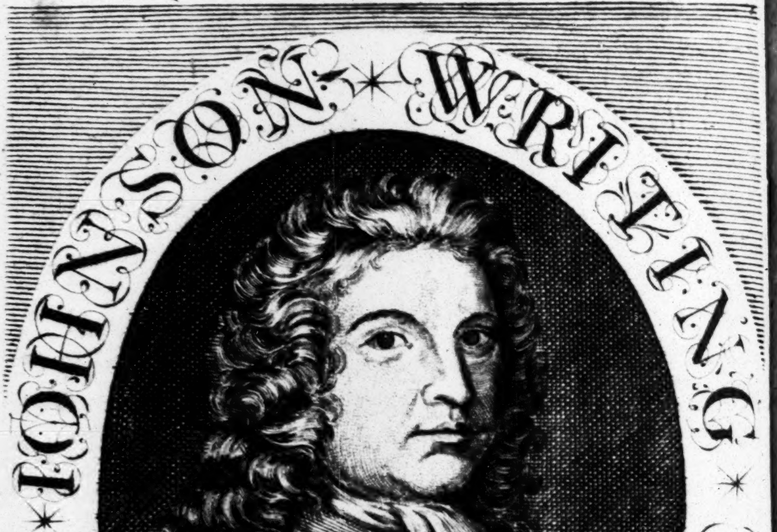

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A

New Treatise

Of Practical

ARITHMETICK,

DONE

In a Plain and Easy Way for the Use of All, but especially for the meanest Capacity to attain a full understanding of that most excellent and useful Science, with great Improvements.

CONTAINING,

Numeration, Addition, Substraction, Multiplication, Division, Reductions of Coin, Weights, and Measure, the Golden Rules of Three, Single and Double, Direct and Reverse, Rules of Practice, Tare and Trett, Fellowship Single and Double, Barter, Loss and Gain, Interest Simple and Compound, Rebate or Discount, Exchange of Coin, Vulgar Fractions, Extraction of the Square and Cube Roots, Measuring of Board, Glazing, Wainscot, Painting, Timber, Stone, &c.

By *HUMPHRY JOHNSON*, Writing-Master in *Old-Bedlam Court* without *Bishopsgate*, where Youth may be Boarded.

LONDON: Printed for *Robert Gifford*, in *Old-Bedlam* without *Bishopsgate*. 1710.

23

ADVERTISEMENT.

IN *a short time will be publish'd (being almost finish'd)* A New Copy-Book of all the usual Hands of *Great-Britain*, Written after the newest Mode, adorn'd with variety of new-invented Turns of Practical Command of Hand, according to the Humour of the Age. Perform'd by the Author of this Treatise: By whom are carefully taught (at home or abroad) Writing, Arithmetick, and Merchants Accompts, after the newest and most improv'd Methods; and (for more Expedition) Youth may be conveniently Boarded.

To the Honourable

Henry Bridges, Esq;

Of *KEYNSHAM*

In the County of *Somerset*.

Honoured Sir,

THE *Profoundness of your Knowledge in the Liberal Sciences, your exquisite Skill in both the Learned and Modern Languages, (acquir'd by long Travels, great Experience, and indefatigable Study,) is too perspicuously known to doubt of your Judgment in Matters of this nature.*

And the good Affection you have always shewn to this useful Science in particular (being the Basis whereon are erected all those beauteous Fabricks and noble Superstructures in the Mathematicks) makes me bold to shelter the following Treatise under your Protection.

Humbly entreating your Acceptance thereof in Acknowledgment of unmerited Favours conferr'd on,

Honoured Sir,

Your most obliged

humble Servant,

Humphry Johnson.

ADVICE
TO THE
READER.

Friendly Reader,

AT the Desire of a Friend, I have drawn up the following Sheets; wherein I have endeavour'd to make that useful Science of *Arithmetick* easy to be learn'd by the meanest Capacity; and that without a Tutor: And the better to accomplish this my Design, (or make my Endeavours effectual) I have observ'd the following Method; namely,

1. I have explain'd all the Terms of Art: Which I have done in their proper places, at the beginning of each Chapter. And,

2. I have explain'd all the *Hard Words* (in the whole Book) which I thought would be any thing difficult to a common Reader. And this I have done by inserting their Signification in a Crotchet, thus; *Definition* [or *Explanation*;] a *Unit* [or *One*;] *Ergo* [*therefore*;] and ſo of the reſt. For I know by Experience, that the not underſtanding the *Terms* and Words of any Diſcourſe, is commonly the chief thing that hinders a Learner from underſtanding the Matter. And yet for any one to learn an Art without its Terms, is very ridiculous.

3. I have call'd the firſt Chapter an *Introduction*, [that is, a *Leading-in*;] wherein I have explain'd the Nature of a *Unit*; which is neceſſary for a Learner to know, it being the

the

the Foundation of *Arithmetick*, as that is of all other Sciences.

4. I have been very large upon the six first Rules, (namely, Numeration, Addition, Substraction, Multiplication, Division, and the Golden Rule,) because I would make them plain and easy to be learn'd by the meanest Capacity, and because these Rules are of absolute Use and Necessity to Men of all Degrees and Professions whatsoever: And many Men *will not*, nor *need not*, learn any farther, their Business not requiring it.

5. I have been brief in the rest of the Rules; because he that perfectly understands the six first Rules, will easily learn the rest, they being all perform'd by some one or more of these.

6. Lastly, (which is not the least Means to make my Endeavours answer Expectation) I have express'd the same Words in Writing that I used to do to my Scholars by word

of mouth; and therefore I hope they will have the ſame good Effect upon thoſe that I know not, as they have had upon thoſe that I know.

And now in learning this ſo neceſſary Art of *Arithmetick*, I adviſe you,

1. To get a perfect Underſtanding of the Terms explain'd in the Beginning of each Chapter. And,

2. Mark well the Signification of any Hard-words wherever you find them explain'd; for the not underſtanding of *theſe*, will be a great Hindrance to the underſtanding of the Rules.

3. I adviſe you to be perfect in one Rule, before you undertake to learn the next: And be not deſirous to paſs on forward, till you are very ready in that which goes before; for the filling the Head with too many things at once, does but diſtract a Learner's Fancy, and diſturb his Apprehenſion. Therefore endeavour to be very perfect in *Numeration*, before you meddle

dle with *Addition*; and in *Addition* before you undertake to learn *Subtraction*; and so of the rest: for a perfect Knowledge of one Rule will be a great Help to you in learning the next, because they have generally a Dependance one upon another.

And by this Method of proceeding, you may make your self Master of *Arithmetick*, or at least arrive to a competent Knowledge thereof with ease, and in a very short space of time.

Humphry Johnson.

From my School in Old-Bedlam Court *without* Bishopsgate, *LONDON.*

IF grateful Muses soar up to the Skies,
T'exalt the Useful Labours of the Wise,
Who lonesome Paths do times repeated tread,
That by their Footsteps others may be led
When they're dissolv'd, and scatter'd with the Dead;
Shan't the unwearied Numerist's Praises shine
I'th' Linage, endless as his Art sublime?
Oh Sacred Genius whence those Rules did spring!
What Tongue can praise, or Muse its Worth can sing?
Whence Use and Profit gratefully arise,
Delight the Mind, and leave it in Surprize.
Writing alone in Competition stands,
And with her Sister Art goes hand in hand:
The Soul of Business, and the Life of Trade,
Writing the Heart, Arithmetick the Head:
Both are with just and equal Praises crown'd,
The noblest Arts by Nature ever found.

ARITHMETICK.

PROEM.

THE Science of *Arithmetick* is thought to be coëvous with the World, or at least with the first Ages thereof. I shall not stand to give an Account of its first *Inventor*; that being so uncertain: Nor shall I much insist on the Excellency and *Usefulness* thereof; that being so generally known and believ'd.

Yet I cannot forbear to take notice in general, That, by many ancient Writers and grave Philosophers, This Science has been accounted the *Primum Mobile*, not only of all Mathematical Sciences, but of all Mundane Affairs in general: And that 'tis useful for all Sorts and Degrees of Men, from the highest to the lowest.

CHAP. I.

The General Introduction.

BRevity (as far as it may consist with Perspicuity, being the Design of the following Discourse, I shall not here insist on the many (and various) *Definitions of Arithmetick*, that are set down by the several Authors that Write of this Subject: Yet (because the *Natural Method of Teaching any Art, is in the first place to explain the Terms belonging to it*) I shall *here* say, That

I. *Arithmetick* is (commonly) defin'd to be, *The Art of Numbering, or Casting Accompt.*

In order to a clear understanding of which Definition, it will be necessary here to consider what is meant by the Word *Number*.

II. *Number* is variously defin'd by several Authors; but the most common Definition [or Explanation] of Number is that of *Euclid's*, who (*Elem. lib.* 7) defines Number to be *A multitude of Units (or Ones) assembled together.*

But *this Definition*, not only, does not in the least explain the Nature of the thing, (which all Definitions ought to do) but also, has been the Occasion of much Dispute and Contention amongst the Learned concerning the Nature of a *Unit* (or *One*:) as, Whether a Unit be *Number?* and, Whether it be to *Number* as a *Point* to a *Line?* Some inferring, That (according to this Definition, *Number is a Multitude of Units assembled together,*) it is visible, That a Unit is no Number, but only the Beginning of Number. But against *this*, others do *thus* argue, —— The *Part* (say

(say they) is of the same Nature with the Whole: A Unit is a part of a Multitude of Units; and therefore a Unit is of the same Nature with a Multitude of Units, and consequently of Number: *Ergo* [therefore] a Unit is Number.

But this Argument is of no Force; For tho' the *Part* were always of the same *Nature* with the Whole, it does not follow, that it ought always to have the same *Name* with the Whole; nay, it often falls out, that it has not the same *Name*. A Soldier is a Part of an *Army*, and yet is no *Army*: A *Chamber* is a Part of a *House*, and yet is no *House*: A Half-Circle is no Circle: A Part of a Square is no Square. So a Unit may be a Part of a Number, and yet this Argument will not prove it to be Number.

Again, That a Unit is Number, others argue thus,—— If from a Number given, we subtract no Number, the Number given remains: If therefore a Unit be no Number, subtract One out of Three, and the Number given will remain; which is absurd. *Ergo*, a Unit is Number.

But in this Argument the Major is ridiculous, and supposes the thing in Question: For *Euclid* will deny that the Number given remains, after Subtraction of another Number. For to make it another Number than what was given, there needs no more than to subtract a part of a Number from it, which (according to him) is the Unit. Besides, If this Argument were good, we might prove in the same manner, That if half a Circle be taken from a given Circle, the Circle given will remain, (because no Circle is taken away;) which is absurd.

III. Notwithstanding all these Arguments, I affirm a Unit to be *Number*; yet I reject the fore-

foregoing Arguments, as being inſufficient to prove it. For all thoſe Arguments prove no more than *this*; namely, That *Number* may be defin'd, [or deſcrib'd,] as to agree with a Multitude of Units. And that it may (nay and ought to) be ſo defin'd, I ſhall ſhew anon: But in the mean time, let us take notice,

IV. That moſt (if not *all*) that adhere to *Euclid*'s Definition of Number, aſſert; That *a Unit is to Number, as a Point is to a Line.* But this is abſolutely falſe: For, a Unit added to a Number, makes it bigger; but a Point added to a Line, does not make it bigger; that is, longer. And a Unit being ſubtracted from a Number, the Number given does not remain; but a Point being taken from a Line, the Line given remains.

V. To come now to what I promis'd in the third Section: I ſay, That the *Definition of any Word, ought to be ſignificant and expreſſive of the Thing ſignified by the Word; or at leaſt, of that general Idea or Conception that all Men have of it.* And therefore (with Submiſſion to better Judgments) I think, That Number cannot be better defin'd, than it has been done by the famous *Simon Steven*, Mathematician to the Prince of *Orange*; who defines it thus: *Number is that by which is explain'd the Quantity of any thing.*

To illuſtrate this Definition a little; Suppoſe in a Heap of Corn, it were demanded How much there were? If the Anſwer were only *Buſhel*, or *Buſhels*, it would be unſatisfactory: it muſt therefore have ſome Number prefix'd to it (as, Nine, Three, One, Half-a-one, or the like) before the Anſwer can be ſatisfactory, or indeed intelligible. So that 'tis plain, *Number is that by which we explain the Quantity of Things.* And therefore the Definition is good.

VI. Now

VI. Now as all Men muſt acknowledge *this* to be a true and natural Definition, 'tis evident and undeniable, That a Unit is as properly Number as a multitude of Units; and that a Unit is ſo far from being the Beginning of Number, that it may rather be ſaid to be the middle Point of Number: For as Number may be increaſed from Unity *ad infinitum* [infinitely] ſo it may be likewiſe decreaſed from Unity *ad infinitum* by continual Diviſion, or taking the Fractions [or Parts] of a Unit. For, as no Multitude of Units can be propos'd ſo great, but a greater may ſtill be ſuppos'd; ſo no Fraction [or Part] of a Unit can be ſuppoſed ſo ſmall, but a leſſer may ſtill be imagined. And yet (as the Learned Dr. *Cudworth* obſerves, (in his *Intelect. Syſt. Univ.*) There can be no Number actually and poſitively infinite, according to *Ariſtotle*'s Definition of Infinity; *viz.* That to which nothing can be added.

Thus much I thought good to premiſe, concerning the Nature of a Unit, [or One,] which is the Grounds of Arithmetick, as Arithmetick is of all other Arts. I ſhall now proceed in our Introduction.

VII. There was a Time when Names of Numbers were unknown, even among civiliz'd Nations; and probably they then apply'd the Fingers (of one or both Hands) to things whereof they would keep account, (as is yet done amongſt the illiterate *Indians*;) and thence it may be that the numeral Words are but Ten in any Language, (and ſome but Five,) and then they begin again; as, after *Decem*, *Undecim*, *Duodecim*, &c. as it were, Ten and One, Ten and Two, *&c.* So we in *Great-Britain* (not much different) after Ten, count Eleven, Twelve, Thirteen, Fourteen,

teen, *&c.* as if Three and Ten, Four and Ten, *&c.*

VIII. The *Ancients* express Numbers by Letters; amongst whom, those of most Note, were the *Greeks* and *Romans*; the former of which, (namely the *Greeks*,) made the Letters significant according to the Order of the Alphabet; thus, α signified One, β Two, γ Three, *&c.* ι Ten, ια Eleven, ιβ Twelve, ιγ Thirteen, *&c.* κ Twenty, λ Thirty, μ Forty, ν Fifty, *&c.* But the *Romans* made their Letters significant more irregularly; for with them,

I	signified	One.
V		Five.
X		Ten.
L		Fifty.
C		a Hundred.
D		Five Hundred.
M		a Thousand, *&c.*

IX. But the Moderns do generally express Numbers by certain *Characters*, thought by most to be invented by the *Arabians*; (though some think they receiv'd them from the *Chinese*:) These *Characters* are by the *Arabians* call'd *Ziphers*; by the *Hebrews*, *Sephers*; and by *Us*, *Cyphers*; but more commonly Figures.

X. These *Characters* or *Figures* are capable to express any Number, tho' never so great; and yet they are but Ten in Number, thus named and characterized.

Characters.	*Names.*
1 ——	One
2 ——	Two
3 ——	Three
4 ——	Four

5 —— Five

5 ———— Five
6 ———— Six
7 ———— Seven
8 ———— Eight
9 ———— Nine
0 ———— a Null, or Cypher.

Of these, the last is of no Value, but serves only to encrease the Value of the rest; as shall be shewn in the next Chapter.

XI. All Numbers exprest by one single Figure are call'd *Digit-Numbers*, so there can be but nine Digits; namely, 1, 2, 3, 4, 5, 6, 7, 8, 9.

XII. All Numbers exprest by one Digit, with one or more Cyphers annexed, are called *Article-Numbers*; such are, 10 [Ten] 20 [Twenty] 30 [Thirty] *&c.* 100 [one Hundred] 200 [two Hundred] *&c.*

XIII. All Numbers exprest by many Digits alone, or by many Digits and Cyphers standing together promiscuously, are call'd mix'd or compound Numbers: such are 11 [Eleven] 12 [Twelve] 21 [Twenty one] 102 [One Hundred and two] 220 [Two Hundred and twenty] *&c.*

CHAP. II.

Of NUMERATION.

I. NUmeration, is that Rule in Arithmetick which *teacheth*, how to read [or express in Words] any Number that is set (or written) down in Figures; and how to set down in Figures, any Sum or Number that shall be required.

II. For

II. For Performing this, you muſt know, That every one of the nine Digits has a different Value according to the Place he ſtands in. And,

III. Theſe Places are counted from the Right-hand towards the Left; thus,

6	2	5	3
Fourth Place.	Third Place.	Second Place.	First Place.

IV. Now, if a Figure ſtand alone, or in the firſt Place, it ſignifies but its own ſingle Value; but ſtanding in the ſecond Place, it ſignifies ten times its ſingle Value; in the third Place, a hundred times; in the fourth Place a thouſand times; and ſo on; every Place farther towards the Left-hand encreaſing its Value ten times as much as was before. So in the Example in the foregoing third Section, the Figure 3 (ſtanding in the firſt Place) ſignifies three *Units*, or ſimply *Three*, and no more; the Figure 5 (in the ſecond Place) ſignifies *Five Tens* or *Fifty*; ſo 53 is *Fifty Three*: the Figure 2 (in the third Place) is *Two hundred*; ſo 253 is *Two hundred fifty three*: the Figure 6 (in the fourth Place) is *Six Thouſand*; ſo 6253 is to be read thus, *Six Thouſand Two Hundred Fifty Three.*

In like manner, if any Figure has a Cypher (or Cyphers) join'd with it, it ſhall ſtill keep the Value of its Place as much as if a ſignifying Figure ſtood in the room of the Cypher or Cyphers. So, if inſtead of the 3 (in the foregoing Example) there were a Cypher in the firſt Place,

Place, thus 6250, the other Figures ſhall keep the ſame Value of their Places that they did before; namely, *Six Thouſand Two Hundred and Fifty.*

V. Thus you may read any 4 Figures: But if the Number conſiſt of more than 4 Places, obſerve the following Table.

The Value of each Figure, according to the Place that he ſtands in.	Examples for the Learner's Practice.						The Number of the Places.
Units.	4	0	0	0	0	4	Firſt.
Tens.	3	7	0	0	3	0	Second.
Hundreds.	2	6	9	0	0	3	Third
Thouſands.	1	5	8	1	2	0	Fourth
Tens of Thouſands.	9	4	7	9	1	2	Fifth.
Hundreds of Thouſands.	8	3	6	8	9	1	Sixth.
Millions.	7	2	5	7	8	0	Seventh.
Tens of Millions.	6	1	4	6	7	9	Eighth.
Hundreds of Millions	5	9	3	5	6	8	Ninth.
Thouſands of Millions.	4	8	2	4	5	7	Tenth.
Tens of Thouſands of Millions	3	7	1	3	4	6	Eleventh
Hundreds of Thouſands of Millions.	2	6	9	2	3	5	Twelfth.
Millions of Millions.	1	5	8	1	2	4	Thirteenth.

In

In the foregoing Table, I have laid down six different Examples, for the Learner's Practice; each of them continued to thirteen Places, which is far enough for any common Practice.

VI. In the Practice of Numeration, or reading of Numbers, I advise the Learner (in the first place) to get by heart the uppermost Column of the foregoing Table, so that he may readily run back (from the Right-hand towards the Left) by *Units*, *Tens*, *Hundreds*, &c. Then let him practise upon three or four of the first Figures (next the Right-hand) in all the six Examples, till he can read them perfectly. Thus the four first Figures of the first Example are to be read, *One thousand Two hundred Thirty Four*; the four first of the second Example are to be read, *Five thousand Six hundred and Seventy*; the four first of the third Example are, *Eight thousand Nine hundred*; and so of the rest, as the Table plainly shews: for the Value of every Figure (according to the Place he stands in) is written over him.

Being perfect in reading four Figures, you may proceed to five, six, seven, eight, and nine; which when you can once read perfectly, you may as easily read a hundred, if you do but make a Point under every seventh Figure inclusively; (namely, under the seventh, the thirteenth, the nineteenth, *&c.*) and repeat the Word *Millions* so often as there are Points remaining. Thus, the first Example in the foregoing Table is, *One Million Millions, two hundred thirty four thousand five hundred sixty seven Millions, eighs hundred ninety one thousand two hundred thirty four.*

When you can distinctly read any Number in the foregoing Table, then write down any Sum or Number of Figures that comes first in your Mind,

Mind, and practice to read them. Do thus, till you find that you can readily and distinctly read any Number that you see written down: For he that learns the following *Rules* of Arithmetick without being perfect in *this* of *Numeration*, were as good learn nothing; for, when he has cast up a Sum, or answer'd a Question in Arithmetick, he can give no Account of it: As for instance, If he were requir'd to find how many Minutes it is since the Creation of the World, which is very easily done; but when he has done it, if he be ask'd How-many they are? he can only say, *Look you there, so many*; but he can't tell you how many; so that he were as good *say nothing*; and it had been as well if he had *done nothing*. So that you see, all the following *Rules* are of no Use without *this*.

VII. This Method of reading Numbers (taught in the foregoing Sections of this Chapter) is the most ancient Method, and is still most in Use amongst common Arithmeticians. But if the Number of Places exceed 13, or 19, (so that the Word *Million* comes to be repeated more than 2 or 3 times) a Number this way exprest is perfectly unintelligible; no Man being able to conceive what kind of Number it is. And therefore, to remedy this Inconveniency, our best modern Arithmeticians have invented several other ways of reading of Numbers: But *these* being of most Use to those that have made some Proficiency in the Mathematicks, (and so have occasion for larger Numbers than any in our Table) I shall omit them in this place.

VIII. When you can readily and exactly read any Number, you may then proceed to the *Second Part of Numeration*; which teaches us, *How to set down in Figures any Number propos'd.*

This

This part of Numeration, all Authors have hitherto omitted; yet herein a little Practice will make you perfect, if you do but observe the following Particulars: Namely,

First, You must take notice what Denominations are wanting in any Number propos'd, and supply those places with Cyphers: And you may pretty easily know what Denominations are wanting, because they are commonly supply'd by the Word *and*; as in these Examples.

How do you set down *One thousand Seven hundred and Nine?* Here the Denomination of *Tens* is wanting, (and in the Proposal is supply'd by the Word *and*) which must therefore (in setting it down) be supply'd with a Cypher; for it must be set down thus, 1709. Again,

How do you set down *Two thousand and Ninety seven?* Here the Denomination of *Hundreds* is wanting; which must therefore be supply'd with a Cypher: for it must be set down thus, 2097.

Secondly, Besure to set no more than 9 in any Denomination, tho' the Number be otherwise proposed; as in this Example:

How do you set down *Eleven thousand Eleven hundred, and Eleven?* This Example many Learners would set down thus, 111111, which is false; for it is *One hundred and eleven Thousand, One hundred and eleven*. But here you must consider, that *Eleven hundred* is *One thousand One hundred*; so that the Number propos'd is properly, *Twelve thousand One hundred and Eleven*, and must be set down thus, 12111. Again,

Let it be requir'd to set down *Eleven millions eleven hundred and eleven thousand eleven hundred and eleven*: which Number is properly *Twelve millions One hundred and twelve thousand One hundred and eleven*; and must be set down thus, 12112111.

Also,

Alſo, Let it be requir'd to ſet down *a Million wanting one*; which muſt be done thus, 999999.

A little Practice will make this part of Numeration perfect; eſpecially if you are firſt perfect in the former Part of this Rule; for by *that* you may eaſily prove whether you have ſet down any Number truly or not: and therefore I ſhall conclude this Rule with a few Examples more for the Learners Practice to ſet down in Figures.

Examples of Numbers for to exerciſe the Learner to ſet down in Figures.

Nineteen.

Twenty nine.

Four hundred Ninety ſeven.

Seven thouſand and Twenty nine.

Forty two thouſand three hundred.

Nine hundred Seventy five thouſand.

Two millions Fifty ſeven thouſand Three hundred Ninety four.

Ninety nine millions Seven hundred forty two thouſand Eight hundred Twenty four.

Five hundred thirty ſeven millions Eight hundred forty two thouſand and Ninety nine.

Twenty millions.

Seven hundred thouſand.

CHAP. III.

Of ADDITION.

I. ADdition is *that* Rule of Arithmetick which teaches how to bring *two* (or more) *Numbers* into *one*; call'd the Sum or *Aggregate*. As if 8 and 9 were given to be added together, their Sum will be 17; and the Sum of 6 and 4 is 10.

II. *Addition* is of two kinds; namely, Simple or *Absolute*, and Compound or *Respective*.

III. Simple or *Absolute Addition* is the adding or bringing together of two (or more) Numbers, whereof we consider only the bare Numbers, without any respect or regard to any thing else; (as if I would add together 12 and 24, their Sum is 36) or at least the Numbers given to be added together are all of Kind, Name, or Denomination, (as Men, Pounds, Ships, Trees, *&c.*) And this part of Addition is perform'd after this manner.

IV. Set the Numbers (to be added together) orderly one under another; that is to say, set Units under Units, Tens under Tens, Hundreds under Hundreds, Thousands under Thousands, *&c.* For Instance,

Let it be required to add together, 434120, and 36972, and 87654, and 46993; they must be placed one under another, thus:

Units.

Hundreds of Thous.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.
4	3	4	1	2	0
	3	6	9	7	2
	8	7	6	5	4
	4	6	9	9	3

The Numbers being rightly placed as you ſee above, then draw a Line under them; and ſo are they fit for Operation. Then beginning with the firſt File [or Row] of Figures next the Right-hand, add them together, and ſet down the odd Digits (if any be) of their Sum directly under the File, and carry the Articles [or Tens] (if any be) in your Mind to the next File; which ſecond File (together with what you carry'd in your Mind) add alſo into one Sum, ſetting down the Digits (if any be) of their Sum directly under *that* File, and carrying the Articles (if any be) to the next or third File; and ſo proceed in the ſame manner, till all be added: Still obſerving to ſet down the odd ones (above Ten or Tens) of the Sum of each File directly under that File; and carrying the Articles (or Tens) as ſo many Ones to the next File.

Example.

What is the Sum of these four Numbers?

$$\left\{\begin{array}{r} 434120 \\ 36972 \\ 87654 \\ 46993 \\ \hline \end{array}\right.$$

Sum 605739

Here I begin, and work thus. I ſay, 3 and 4 is 7, and 2 is 9; which I ſet down under the firſt File. Then I go to the next File, ſaying, 9 and 5 is 14, and 7 is 21, and 2 is 23; 3 and go 2; [that is, I ſet down 3, and carry 2 to the next place] Then I go to the 3d File, ſaying, 2 that I carry and 9 is 11, and 6 is 17, and 9 is 26, and 1 is 27; 7 and go 2; [that is, I ſet down 7, and carry 2 to the next place.] Then I go to the 4th File, ſaying, 2 that I carry and 6 is 8, and 7 is 15, and 6 is 21, and 4 is 25; 5 and go 2; [that is, I ſet down 5, and carry 2 to the next place.] Then I proceed to the fifth File, ſaying, 2 that I carry'd and 4 is 6, and 8 is 14, and 3 is 17, and 3 is 20; 0 and go 2; [that is, I ſet down 0, and carry 2 to the next place.] Then I go to the laſt File, ſaying, 2 that I carry'd and 4 is 6; which I ſet down. And ſo the Work is finiſh'd.

Note, 1. That when you come to the laſt File, you muſt always ſet down the whole Sum of that File, let it be what it will: as in this Example.

Numbers to be added,

$$\left\{\begin{array}{r} 984721 \\ 643268 \\ 472673 \\ 298654 \\ \hline \end{array}\right.$$

Sum 2399316

Note, 2. That if one of the Numbers to be added conſiſt of more Figures than the reſt, thoſe

Figures

Figures must be brought down, and set down with the rest of the Sum; as in this Example.

Numbers to be added,	6876432
	12463
	7896
	4327
Sum	6901118

This is the whole Art of Addition of Absolute Numbers; which, if well observ'd, you cannot easily miss of adding up a Sum right. I shall therefore only add a few Examples more for the Learners Practice, and proceed to the other part of Addition.

More Examples for the Learner's Practice.

Men.	*Sheep.*	*Oxen.*
7492	742	7654
4274	178	1745
6727	427	4272
1749	174	274
174	427	17
65	174	2

Questions to exercise the Learner in Addition of Numbers of one Name.

Quest. 1. Suppose a Merchant hath in Money five thousand Pounds, in Diamonds to the Value of eight hundred and fifty Pounds, in Plate to the Value of two hundred and forty Pounds, in several sorts of Goods to the Value of seven thousand Pounds, in Estate ten thousand Pounds; What is the Merchant worth in all?

Answer, 23090 Pounds.

Quest. 2. If the Queen hath in *Flanders* thirty thousand Men, in *Germany* fifteen thousand Men, in *Spain* twelve thousand seven hundred Men, in *Portugal* nine thousand eight hundred Men, in the Navy fourteen thousand nine hundred Men, in *Great-Britain* nine thousand five hundred Men; How many Men are there in all in her Majesty's Service?

Answer, 92100 Men.

Compound or *Respective Addition*, is the bringing into one Sum several Numbers of different Denominations [or Names] as Pounds, Shillings, and Pence; or, Pounds, Ounces, and Drams; or, Yards, Quarters, and Nails, *&c*,

This Part of *Addition* is perform'd by this plain and general Rule.

Set the Numbers (to be added together) one under another, in such Order that each Denomination may stand under his like; as, Pounds under Pounds, Shillings under Shillings, Pence under Pence; and so of any other Denomination, as *Weights*, *Measure*, *Time*, &c. Then (having drawn a Line under them) begin at the least Denomination, (*viz.* the File or Row of Figures next the Right-hand) and add them into one Sum; and having so done, consider how many of that Denomination goes to make one of the next greater Denomination, and set down the odd ones, carrying so many to the next File as their Sum made Units in the first File.

As for Example, in adding of Money: for every 4 in the Farthings you must carry 1 to the Pence (because every 4 of the Farthings make a Penny:) for every 12 in the File of Pence carry 1 to the File of Shillings, (because every 12 Pence is a Shilling:) and for every 20 contain'd

tain'd in the File of Shillings, carry 1 to the Pounds, (because 20 Shillings is a Pound:) And the odd Farthings, Pence, and Shillings, must be set down in their proper Places under the Line, as is done in the following Examples. Understand the same of any other Denominations; as, Weights, Measures, Time, and the like; For this is all the Difference between *Absolute* and *Respective Addition.*

> *Addition* Absolute *the Tens doth carry*;
> Respective, *as Denominations vary.*

I shall illustrate this Rule by Examples in all the several kinds of Compound or Respective Addition most in Use; beginning with

Addition of Money.

And here, because there are two ways of Casting-up Sums of Money in Use, (namely, the *London-Way* and the *Country-Way*) I believe it will not be amiss if I treat of them both; which I shall do with as much Plainness and Brevity as possible. But before I proceed, you must note,

1. That 4 Farthings make a Penny, 12 Pence a Shilling, and 20 Shillings a Pound Sterling, or *English* Money.

2. That over our Accounts we generally write *li.* for *(Libri)* Pounds, *s.* for (*Solidi*) Shillings, *d.* for (*Denarii*) Pence, and *q.* for (*quadrantes*) Farthings.

But the Marks of Farthings are more commonly thus:

$\frac{1}{4}$ For one Farthing.
$\frac{1}{2}$ For two Farthings.
$\frac{3}{4}$ For three Farthings.

 Having

Having premis'd this, I begin with the first, or *London-Way*, which is done by the help of the following Table, which must be got by heart.

The Table of Pence.

d.		s.	d.	
20	is	1	8	
30		2	6	
40		3	4	
50		4	2	
60		5	0	or a Crown.
70		5	10	
80		6	8	or a Noble.
90		7	6	
100		8	4	
110		9	2	
120		10	0	or an Angel.
130		10	10	
140		11	8	
150		12	6	
160		13	4	or a Mark.

After the Table of Pence being got by heart, then suppose the following Sums were given to be added together: *viz.*

225 *l.* 07 *s.* 08 *d* $\frac{1}{4}$, and 174 *l.* 12 *s.* 10 *d.* $\frac{1}{2}$, and 274 *l.* 06 *s.* 05 *d.* $\frac{3}{4}$, and 142 *l.* 10 *s.* 07 *d.* $\frac{1}{4}$, and 421 *l.* 09 *s.* 04 *d.*

The Numbers being placed according to Order, as before directed, will stand thus:

li.	s.	d.
225	07	08 $\frac{1}{4}$
174	12	10 $\frac{1}{2}$
274	06	05 $\frac{3}{4}$
142	10	07 $\frac{1}{4}$
421	09	04

I be-

I begin with the least Denomination or File of Farthings, saying, ¼ and ¾ is 4, and ½ is 6, and ¼ is 7 Farthings; which I consider makes 1 Penny and 3 Farthings: wherefore I put down 3 Farthings under the Farthings, and carry the Penny to the next Row or place of Pence, saying, 1 that I carried and 4 is 5, and 7 is 12, and 5 is 17, and 10 is 27, and 8 is 35 Pence; which (by the help of the foresaid Table of Pence) I consider makes 2 Shillings and 11 Pence: wherefore I put down 11 under the Row of Pence, and carry the 2 Shillings to the next Row or place of Shillings, saying, 2 that I carried and 9 is 11, and 10 is 21, and 6 is 27, and 12 is 39, and 7 is 46 Shillings; which I consider makes 2 Pounds 6 Shillings: wherefore I put down 6 under the Row of Shillings, and carry the 2 Pounds to the first Row of Pounds, saying, 2 that I carried and 1 is 3, and 2 is 5, and 4 is 9, and 4 is 13, and 5 is 18: wherefore I set down 8 under the first Row of Pounds, and carry 1 to the second Row of Pounds, saying, 1 that I carried and 2 is 3, and 4 is 7, and 7 is 14, and 7 is 21, and 2 is 23; wherefore I set down 3 under the second Row of Pounds, and carry 2 to the third and last Row, saying, 2 that I carried and 4 is 6, and 1 is 7, and 2 is 9, and 1 is 10, and 2 is 12; wherefore I set down 12, because it is the Sum of the last Row. And so the whole Work is done: And the Sum appeareth to be as followeth.

	li.	*s.*	*d.*
	225	07	08 ¼
	174	12	10 ½
	274	06	05 ¾
	142	10	07 ¼
	421	09	04
Sum	1238	06	11 ¾

Note, in adding up the last (or greatest) Denomination of any Sum in Respective or Compound Addition, you must always carry the Tens as in Absolute or Simple Addition.

I shall now proceed to shew you the other way of Addition of Money, for the doing of which take this Example.

Example,

A Tradesman brings in his Bill to a Gentleman, wherein are the following particular Sums; What is the whole Sum of this Bill?

l.	*s.*	*d.*	*q.*
4	16.	11.	2
3	·14	10.	1
5	10	09.	3.
2	.19	06	2.
6	13	08.	1
2	.12	10.	2
1	09.	09	3.
2	16	06.	0
3	.18.	08.	2.
2	10	10	1
1	09	09.	2
38	14	04	3

Thus I begin with the File (or Column) of Farthings, saying 2 and 1 is 3 and 2 is 5, which makes 1 penny and 1 farthing over; wherefore I make a Point or Speck against the 2 and carry on the 1 farthing, saying 1 and 3 is 4, which makes another penny, wherefore I make a point against 3, and proceed, saying 2 and 1 is 3 and 2 is 5, which makes another penny and 1 farthing

thing over; I make a point against 2, and carry on the 1 farthing, saying, 1 and 3 is 4, which makes another Penny; wherefore I make a point against 3, and go on, saying, 1 and 2 is 3, (which not amounting to a penny) I set down under the line; but the pence that amounted of the sum of the farthings I carry to the File of pence: Wherefore I look how many points I have in the farthings (which are 4) for so many pence have I to carry to the File of pence; Then I go to the File of pence, saying, 4 *d.* that I carry and 9 *d.* is 13 *d.* that is 1 *s.* and 1 *d.* wherefore I make a point against 9, and carry on the 1 *d.* saying, 1 *d.* and 10 *d.* is 11 *d.* and 8 *d.* is 19 *d.* that is 1 *s.* 7 *d.* wherefore I make a point against 8, and carry on the 7 *d.* to the next Figure. In the same manner I proceed (still making a Point against the Figure where it amounts to a Shilling) till I have cast up the whole File of Pence, where I find at last 4 odd Pence, which I write under the Line: Then I look how many Points I have in the Pence, which are 8; wherefore I carry 8 to the File of Shillings, adding up first the Units of Shillings, and making a Point wherever it amounts to 20; and in adding up this File, I find 4 odd Shillings, which I set down under the Line: Then I go to the Tens of Shillings, and (because every 2 of them make a Pound) I make a Point against every 2 of them, and in the end I find an odd one, which I set down also under the Line: Then I see how many Points I have on both sides the Shillings, and they are 7; wherefore I carry 7 to the File of *Pounds*, which I add up as in Addition of Absolute Numbers; and so the whole Sum appears to be 38 *l.* 14 *s.* 4 *d.* 3 *q.*

I have

I have been ſo large in ſhewing how to work theſe Examples both ways, that I think it needleſs to ſay any more on this Head. I ſhall therefore only add a few Examples for the Learner's Practice, leaving him to work them himſelf; only I ſhall add here and there a Note, as occaſion requires.

Example.

A Steward gathering up Rents for his Lord has receivd of ſeveral Men, A, B, C, D, E, F, G, the following Sums: How much has he receiv'd in all?

		lib.	s.	d.
Receiv'd of	A.	450	19	06
	B.	362	12	03
	C.	244	13	04
	D.	210	10	06
	E.	116	16	08
	F.	64	14	09
	G.	40	10	06
Anſwer		1490	17	c6

A Bill

A Bill of House Expences to Exercise Addition.

1710		l.	s.	d.
March 9	Paid for a Book to keep these Accounts	00	01	04
	Wine and Oysters	00	05	06
12	Bread and Cheese	00	02	04
	Butter and Eggs	00	01	02
	Half a Peck of Flower	00	00	08
15	Beef and Mutton	00	06	02
	Two Dozen of Candles	00	14	04
	Roots and Herbs	00	00	08
	Drinking Glasses	00	02	04
27	Gave to New Bedlam	00	00	02
	Veal and Bacon	00	04	06
	Paid the Taylor's Bill	03	16	00
	A Hood and Furbelow Scarf	03	15	06
	A Suit of Knots and Gloves	00	06	00
April 2	Fish and Anchovies	00	01	04
	Gave the Poor	00	00	06
	Paid the Butcher's Bill	02	10	04
	Oatcakes and Wheat	00	01	04
	Brandy and Lemons	00	04	06
6	Paid a Quarter's Rent	05	15	00
	Sugar and Nutmeg	00	01	02
	Gave at a Christning	00	05	00
9	A Pair of Stockings and Shoes	00	09	06
	A Chaldron of Coals	01	16	00
	Paid the Draper's Bill	07	10	04
	Veal Pork and Tripe	00	10	06
	Coffee and Tea	00	12	04
15	Salt, Vinegar and Pepper	00	05	04
	A Bushel of Meal	00	05	06
	A Quarters Wages to the Maid	01	00	00
	Soap and Fuller's Earth	00	00	06
	Three Quarts of Wine	00	06	00

		l.	s.	d.
April 27	Ten Bushels of Malt	01	10	06
	Hops and Yest	00	03	06
	Brewing	00	01	06
29	Fowls, Bacon and Sprouts	00	07	08
	Lobsters and Crabs	00	02	02
	A Cheshire Cheese	00	08	04
	To the Minister	00	05	00
	Pork and Peas	00	02	02
May 2	To a Physician.	00	10	00
	To the Apothecary.	00	05	04

A Grocer's Bill of small Parcels to exercise Addition.

Mr. Longwinded *Dr. to* John Trustall, *Grocer.*

1710.		l.	s.	d.
March 4	For one Pound of Sugar	0	00	10
	Two Ounces of Cloves	0	00	08 ½
5	Four Pound of Sugarcandy	0	04	04
	Half a Pound of Rice	0	00	04 ½
12	One Ounce of Mace	0	00	07 ½
	One Sugar-loaf	0	02	06
	Four Pound of Sugar	0	02	08
April 7	One Ounce of Ginger	0	00	04 ¾
	Half a Pound of Currants	0	00	05
15	One Pound of Tobacco	0	02	04
	Three Pound of Sugarcandy	0	03	03
28	Half a Pound of Raisins	0	00	03 ¼
	Two Ounces of Nutmegs	0	01	04 ½
	One Ounce of *Jamaica* Pepper	0	00	02 ¼
30	Two Pound of Figgs	0	00	07
	Half an Ounce of All-spice	0	00	01 ½
	Two Pound of Sugar	0	01	08
	Total	1	02	08 ¾

Note, To ſet down a Sum in right Form and Order, is as neceſſary as to add them up right when ſet down: It may not therefore be amiſs to propoſe a Queſtion of this nature to exerciſe the Learner therein.

Example.

Suppoſe I am indebted to A, two hundred ninety four Pounds, ten Shillings, and ten Pence; to B, five hundred forty nine Pounds, fourteen Shillings, and three Pence; to C, three hundred Pounds, eight Shillings, and eight Pence; to D, ſeven hundred ninety nine Pounds, twelve Shillings, and ſix Pence; and to E, ninety four Pounds, ſixteen Shillings, and nine Pence: What am I indebted in all?

Anſw. 2039 *l.* 03 *s.* 00 *d.*

Having obſerv'd that there are ſeveral Sums, which, in common way of ſpeaking, are expreſs'd after a quite different manner from the way they are wrote down; I thought it not improper to exerciſe the Learner in them, that he may not be (as ſome are) at a loſs how to ſet down properly any thing of this nature, which may happen in his way.

I ſhall propoſe the Example by way of a Bill of Disburſement, as followeth:

Example.

Example.

Laid out in Lamb eight Groats.
In a Sallet, ſeven Farthings.
In a Cheeſe, two and twenty Pence.
In Butter and Eggs, fifteen Pence.
In Pepper and Vinegar, three Half-pence.
In Bread, nineteen Pence Half-peny.
In Shoes, eleven Groats and two Pence.
In a Chaldron of Coals, ſix and thirty Shillings.
In ſeveral other things to the Sum of ſeven and fifty Shillings.
What does the whole amount to?

Anſw. 5 *l.* 04 *s.* 05 *d.* $\frac{3}{4}$.

Thus have I done with Addition of Money; I ſhall now go on to the ſeveral Weights and Meaſures, which are done after the ſame manner as Pounds, Shillings, and Pence; only obſerving the Notes, and conſider how many of one Denomination goes to make one of the next bigger Denomination, and ſo to point and carry accordingly.

Addition of Avoirdupois-Weight.

Note 1. That 16 Drams make an Ounce, 16 Ounces a Pound, 28 Pound a Quarter of a Hundred, 4 Quarters of a Hundred are a Hundred Weight, and 20 Hundred a Tun.

Note 2. The Marks or Characters by which this Weight is commonly expreſt, are theſe, *viz.* *T.* for Tuns, *C* for Hundreds, *Qr.* for Quarters of a Hundred, *lb.* for Pounds, *oz.* for Ounces, and *dr.* for Drams.

Example 1. *of Avoirdupois Great Weight.*

T.	*C.*	*qr.*	*lb.*
2	18.	3.	27.
1	.16	2	20.
2	14	1	12
1	.12	3.	10.
2	10	2.	18
1	09.	0	20.
2	08	3.	16
15	11	2	11

Example 2. *Of Avoirdupois Small Weight.*

lb.	*oz.*	*dr.*
8	15.	15.
7	12	10
6	10.	12.
4	08	09
3	13.	14
31	13	12

Note 3. In the firſt Example of Avoirdupois Weight, the Pounds are pointed at 28, the Quarters at 4, and the Hundreds at 20. And in the ſecond Example the Drams are pointed at 16, and the Ounces at 16. In your Addition, carry the Points of one Row to the other, becauſe they make ſo many of the next Denomination. The ſame Method of Pointing is to be obſerv'd in all the reſt of the Examples following, according to the Notes laid down.

Note 4. By Avoirdupois Weight are commonly weighed Butter, Cheeſe, Wax, Tallow, Fleſh, Pitch, Rozin, Lead, Iron, all ſorts of Grocery Wares, and all ſuch kind of Garble whence there may iſſue a Waſte.

Note 5.

Note 5. A Pound Avoirdupois, (containing 16 Ounces) is equal to 14 Ounces, 12 Penny-weight, Troy-Weight. Hence it is, that tho'

A Pound of Feathers and a Pound of Lead
Are equal, 'tis not so with Cheese and Bread.

For Cheese is weigh'd by the Pound Avoirdupois; but Bread is weigh'd by the Pound Troy; so that a Pound of Cheese is heavier than a Pound of Bread.

Note 6. Wool is also weighed with the Avoirdupois Weight: Thus for Wool, 7 Pounds is a Clove, 2 Cloves is a Stone, 2 Stone a Tod, 6 Tods and a half a Wey, and 12 Sacks a Last.

XI. *Addition of* Troy-Weight.

Note 1. That 24 Grains make a Penny-weight, 20 Penny-weight an Ounce, and 12 Ounces a Pound Troy-weight.

Note 2. The Characters or Marks by which Troy-Weights are commonly noted, are, *lb.* for Pounds, *oz.* for Ounces, *dw.* for Penny-weights, and *gr.* for Grains.

Example.

lb.	*oz.*	*dw.*	*gr.*
14	11.	19.	23.
12	10.	15.	20.
10	09	10.	06.
8	06.	03	09
6	04	12	14
53	07	02	00

Note 3. By Troy-weight are weighed Bread, Gold, Silver, and Electuaries.

Note 4. The Pound Troy (consisting of 12 Ounces) is equal to about 13 Ounces 2 Drams and a half, Averdupois.

XII. *Ad-*

XII. *Addition of* Apothecaries Weights.

Note 1. Apothecaries Weights are the Troy Pound, but differently divided; for with them 20 Grains make a Scruple, 3 Scruples a Dram, 8 Drams an Ounce, and 12 Ounces a Pound.

Note 2. The Characters or Marks whereby Apothecaries Weights are commonly noted, are, ℔. for Pounds; ℥. for Ounces; ʒ. for Drams: ℈. for Scruples; and gr. for Grains.

Example.

℔	℥	ʒ	℈	gr.
4	10	7.	2	19.
3	10.	6.	1.	10
2	09.	5	0	06.
1	08.	4.	2	04
1	06	3	1.	12
14	11	3	2	11

XIII. *Addition of* Liquid Meaſure.

Note, 2 Pints make a Quart, 2 Quarts a Pottle, two Pottles a Gallon, 42 Gallons a Tierce, or third part of a Pipe or Butt, 63 Gallons a Hogſhead, 2 Hogſheads a Pipe or Butt, and 2 Pipes or Butts a Tun,

Example.

Example of Wine Measure.

T.	hhds.	gal.	Pts.
37	3	18	5.
48	2.	24	0
67	1	20.	6.
38	2.	17	7.
79	0	47.	3
64	1	52	4
335	3	55	1

XIV. *Addition of* Dry-Meaſure.

Note, In Dry Meaſure, 2 Pints make a Quart, 2 Quarts a Pottle, 2 Pottles a Gallon, 2 Gallons a Peck, 4 Pecks a Buſhel, 8 Buſhels a Quarter, 4 Quarters a Chaldron, and 5 Quarters a Wey: But 36 Buſhels is a Chaldron of Sea-Coal in *London*.

Example.

Chald.	qrs.	Buſh.	Peck.
148	3.	6.	3.
375	1	7.	2
296	2.	4	3.
128	1	5.	0
94	0	5.	2.
38	2.	4	3
1082	1	2	1

XV. *Ad.*

XV. *Addition of* Long-Measure.

Note, That 3 Barley-corns make an Inch, 12 Inches a Foot, 3 Foot a Yard, 3 Foot and 9 Inches an Ell, 6 Foot a Fathom, 16 Foot and a half a Statute Pole or Perch, 40 Perches a Furlong, and 8 Furlongs a Mile.

Example.

Mil.	*Furl.*	*Per.*
48	7.	24.
37	3	18
65	5.	28.
36	5	00
20	6.	20
209	4	10

XVI. *Addition* of Cloth-Measure.

Note, That 2 Inches and a quarter make a Nail, 4 Nails make a quarter of a Yard, 3 quarters of a Yard make an Ell *Flemish*, 4 quarters a Yard *English*, and 5 quarters of a Yard, or 45 Inches, is an Ell *English*.

Example 1.

Yds.	*qrs.*	*na.*
16	3.	3.
14	2	1
12	1.	2.
10	3	1
9	2.	2.
8	3.	3
73	1	0

Example 2.

Ells.	*qrs.*	*na.*
12	4.	3.
11	3.	2
10	2	1.
9	4.	3
8	2	1.
7	3.	2
6	4.	1
68	0	1

XVII. *Addition of* Land-Meaſure.

Note, 40 Square Poles or Perches make a Rood, or quarter of an Acre, and 4 Roods make an Acre.

Example.

Acr.	*Roods.*	*Per.*
120	2	.34
275	3.	14
162	1	.35
98	2.	20
47	3	.30
64	1.	15
769	3	28

Note,

XVIII. *Addition of* Time.

Note, 60 Minutes make an Hour, 24 Hours a Day, 365 Days a Year.

Example.

Da.	*Ho.*	*Mi.*
20	23.	.59
16	20.	.40
14	16	36
12	14.	.28
10	18.	12
8	16	16
84	14	11

XIX. The beſt Proof of Addition is to add it up again; (for the Old Proof by caſting away the 9's, or ſeparating it in two parts, as taught by ſome, is not at all uſed in Buſineſs;) I commonly add it once upwards and once downwards, and if they agree, I conclude it right; but if they do not agree, I add it over again both ways till I make them agree.

CHAP.

CHAP. IV.

Of SUBTRACTION.

I. SUbtraction is that Rule which teaches how to take a *lesser Number* out of a *greater*, to find their Difference, or how much one of the two given Numbers is bigger than the other.

II. Of the two given Numbers, the lesser Number is call'd the *Subtrahend*, [or Number to be subtracted] and the greater Number is call'd the *Minorand*, [or Number to be made less] and the Difference of the two Numbers is call'd the *Remainder*.

Thus, If I would subtract (or take) 12 out of 16, there would remain 4; in which Example 12 is the *Subtrahend*, 16 is the *Minorand*, and 4 is the *Remainder*.

III. Subtraction is also of two kinds, namely Simple or Absolute, and Compound or Respective.

IV. *Simple* or *Absolute Subtraction*, is the Subtraction of Simple or Absolute Numbers; (what *they* are, has been shewn above, in Chap. III.) And is perform'd by this Rule:

Set the lesser Number under the greater, in such order that Units may stand under Units, Tens under Tens, &c. as in Addition. Then (having drawn a Line under them) begin at the Right-hand, and take the first Figure of the Subtrahend (or under Number) out of the first Figure of the Minorand, (or upper Number) and set the Remainder (exactly under

under him) under the Line: Then go to the ſecond Figure, (or place of Tens) of the Subtrahend, and take it likewiſe from the Figure over it, ſetting the Remainder under it, as before. Do the ſame by all the reſt of the Figures; ſo the Number under the Line will be the Remainder.

Example.

Let it be requir'd to ſubtract (or take) 21 from 49: Or, How much is 49 bigger than 21?

Here I ſet down the given Numbers as directed above, ſetting 21 under 49, and drawing a Line under them: Then I begin at the Place of Units, ſaying, 1 from 9 and there remains 8, which I ſet (under 1) underneath the Line; and proceed to the next place, ſaying, 2 from 4 and there remains 2, which I alſo place under the Line. So the Work is finiſhed; and I find the Remainder (or Difference betwixt 21 and 49) is 28: As you may ſee by the Work in the Margin.

49
21
28

More Examples of the ſame nature.

From	743	586	3785	*Minorand.*
Subtract	121	270	205	*Subtrahend.*
Remains	622	316	3580	*Remainder.*

But if it happen (as many times it will) that any Figure of the Subtrahend, [or lower Number] is bigger than the Figure over him, (ſo that you cannot take it from him) then always add 10 to the upper Figure, and from their Sum ſubtract the Figure under it, ſetting the Remainder

under the Line; and when you go to the next Figure below, add 1 thereto, and then ſubtract it from the Figure over it, if you can, if not, add 10 as before: Do thus as often as you have occaſion.

Example.

Let it be requir'd to ſubtract 4762 from 6681.

The Numbers being plac'd as I before directed, and a Line drawn under them; I begin at the Right-Hand, ſaying, 2 from 1 I cannot take, but (adding 10 to 1, it makes 11, therefore I ſay) 2 from 11, and there remains 9, which I ſet under the Line; and proceed to the next place, ſaying, 1 that I borrow'd and 6 is 7, from 8, and there remains 1, which I alſo ſet under the Line; then I go to the next Figure, ſaying, 7 from 6 I cannot, but (adding 10 as before) 7 from 16 and there remains 9, which I ſet down, and proceed, ſaying, 1 that I borrow'd and 4 is 5, from 6, and there remains 1, which I alſo ſet down under the Line, and ſo the Work is finiſhed, and I find the Remainder to be 1919, as you may ſee in the Margin.

6681
4762
1919

More Examples of the ſame nature.

From	3475016	3615746	*Minorand.*
Subtract	738642	5864	*Subtrahend.*
Remains	2736374	3609882	*Remainder.*

V. But becauſe all Arts are beſt learn'd, when the Reaſon of the Rule is given, I ſhall here inform the Reader of the Reaſon why we always add 10 to the upper Figure, when he is leſs than the Figure under him, and why we always add

add 1 to the next Figure below: Now the reaſon is this, When the upper Figure is leſs than the Figure under him, we borrow 1 from the next upper Figure, and becauſe (as you learnt in Numeration) every 1 in *that* place is 10 in *this*, therefore that 1 which we borrow is 10, and this 10 we add to the Figure that was too little. Then the reaſon why we add 1 to the next Figure below, is this, Becauſe tho' 1 is ſuppos'd to be borrow'd or taken from the next upper Figure, yet the Figure ſtands for his full value, as he did before, and conſequently he now ſtands for 1 more than really he is, becauſe 1 is ſuppos'd to be taken from him) and therefore we add 1 to the next Figure below, to make him alſo 1 more than he is, that there may be the ſame Difference betwixt them as there was before. So in the Example above, where 4762 is ſubtracted from 6681, becauſe I can't take 2 from 1, I borrow 1 out of 8, ſo there remains but 7; yet the Figure 8 ſtands ſtill, and therefore he now ſtands for 1 more than he is; and becauſe every 1 in the *ſecond* place makes 10 in the *firſt*, therefore that 1 which I borrow'd is 10, which I add to the 1, and it makes 11, out of which I ſubtract 2, and there remains 9. Then I go to the next Figure of the Subtrahend, namely 6, and add 1 to him, that he alſo may be 1 more than he is, as well as the Figure 8 over him. This is the true reaſon of Borrowing and Paying in Subtraction, which Hundreds (who think themſelves good Arithmeticians) are ignorant of.

VI. The Proof of Subtraction is very eaſy; thus——— Add the Subtrahend to the Remainder; and if their Sum be equal to the Minorand, then is the Subtraction truly wrought, elſe not. The Reaſon of this Rule is evident; for the Re-

mainder is the Difference of the two Numbers, or how much the greater Number is bigger than the leſſer; and therefore if this Difference be added to the leſſer Number, it muſt make the greater Number again.

Example.

From ———	43758	*Minorand.*
Subtract ———	3872	*Subtrahend.*
	39886	*Remainder.*
	43758	*Proof.*

VII. Compound or Reſpective Subtraction, is the Subtraction of Compound or Reſpective Numbers; (What they are was ſhewn above in Chap. III. of Addition.) and is perform'd by this Rule.

Set the Leſſer Number under the greater, in ſuch Order, that every Denomination may ſtand under his like, as Pounds under Pounds, Shillings under Shillings, Pence under Pence, *&c.* and ſo of any other Denominations, whether they be Weight, Meaſure, Time, or the like. Then begin at the leaſt Denomination, (namely that next the right hand) and ſubtract the undermoſt Numbers from thoſe over them, and ſo proceed gradually towards the Left-hand (ſetting the Remainder of each Denomination under the Line) till all be finiſh'd.

Example.

	l.	*s.*	*d.*	*q.*	
Borrow'd	36	12	10	2	*Minorand.*
Paid	24	08	06	1	*Subtrahend.*
Reſts to pay	12	04	04	1	*Remainder.*
	36	12	10	2	*Proof.*

The

The Numbers being plac'd as before, and a Line drawn under them; I begin at the Right-Hand, ſaying, 1 Farthing from 2 Farthings, and there remains 1 Farthing, which I ſet under the Line in the place of Farthings, and proceed to the next Denomination; namely, that of Pence, ſaying, 6 Pence from 10 Pence, and there remains 4 Pence, which I alſo ſet under the Line; then I go to the Shillings, ſaying, 8 Shillings from 12 Shillings, and there remains 4 Shillings, which I ſet down under Shillings; and laſtly I go to the Pounds, ſaying 4 from 6, and there remains 2, which I ſet down under the Line; and proceed, ſaying, 2 from 3, and there remains 1. So the Work is finiſhed; and I find the Remainder to be 12 *l.* 4 *s.* 4 *d.* 1 *q.*

But if the lowermoſt Number in any Denomination chance to be greater than the Number over it; then borrow one from the next Denomination, and turn it into the Parts of the leſſer Denomination, and add thoſe Parts to the upper Number, and from their Sum ſubtract the lower Number, ſetting the Remainder under the Line; and then proceed, and (for the 1 you borrow'd) add 1 to the next lower Number; and proceed in the ſame Order, till all be finiſhed.

Example.

	l.	*s.*	*d.*	*q.*	
From	24	06	10	1	*Minorand.*
Subtract	22	18	05	3	*Subtrahend.*
	1	08	04	2	*Remainder.*
	24	06	10	1	*Proof.*

Here I ſay, 3 Farthings from 1 Farthings I cannot, but (borrowing 1 Penny, that is 4 Farthings, I ſay) 3 from 5, reſts 2, which I ſet under the Line. Then I go to the next Denomination, ſaying, 1 Penny that I borrow'd and 5 Pence is 6 Pence, then 6 Pence from 10 Pence and there remains 4 Pence, which I ſet under the Line. Then I go to the Place of Shillings, ſaying 18 Shillings from 6 Shillings I cannot, (but borrowing 1 Pound, that is 20 Shillings) I ſay, 18 from 26, reſts 8, which I ſet under the Line. Then I proceed to the Pounds, ſaying, 1 that I borrow'd and 2 is 3, and 3 from 4, reſts 1, which I ſet down. Laſtly, 2 from 2, there remains 0. So the Work is finiſhed; and the Remainder is 1 *l.* 8 *s.* 4 *d.* 2 *q.*

Note, If you have occaſion to borrow in the laſt Denomination, you muſt always borrow 10, as in Subtraction of Abſolute-Numbers.

This is all the Difference betwixt Addition and Subtraction,

Subtraction is the taking leſs *from* more,
Borrowing inſtead of Carrying, as before.

VIII. It many times happens that many Sums or Numbers are to be ſubtracted from one Number: As, if there be a Sum lent, and Payment made at ſeveral times in part, and you would know how much remains due. In this caſe you muſt add the ſeveral Payments into one Sum, and ſubtract that Sum from the Sum lent, and the Remainder will ſhew you how much is due.

Example.

Example.

	l.	*s.*	*d.*	*q.*	
Borrowed	3300	00	00	0	*Minorand.*
Paid at seve-ral Paym.	170	10	00	0	*To be added together.*
	361	13	10	1	
	590	03	04	3	
	73	04	11	3	
Paid in all	1195	12	02	3	*Subtrahend.*
Remains due	2104	07	09	1	*Remainder.*

More Questions to exercise the Learner.

	l.	*s.*	*d.*
Borrow'd of my Neighbour, —	150	10	06
Paid him again, ———	075	15	10
Remains to pay, ———			

The Draper's Bill comes to —	48	12	04 $\frac{3}{4}$
Paid him in part———	37	15	06
Remains due to him ———			

Lent a Friend———	264	10	09 $\frac{1}{4}$
Receiv'd in part, ———	174	15	10 $\frac{1}{2}$
Remains due to me———			

From 272*l.* 17*s.* 10*d.* take 174*l.* 18*s.* 11*d.* and tell me what remains?

Out of 825 *l.* 19 *s.* 10 *d.* take 672 *l.* 18 *s.* 11 *d.* and shew the difference.

Borrow'd 742 *l.* 18 *s.* 10 *d.* Paid 140 *l.* 17 *s.* 9 *d.* $\frac{1}{2}$. What remains unpaid?

Lent 752 *l.* 14 *s.* 11 *d.* $\frac{1}{4}$ Receiv'd 649 *l.* 17 *s.* 10 *d.* $\frac{3}{4}$. What remains due?

If you lend a Man four hundred ninety seven Pounds, ten Shillings, and nine Pence; and receive of him one hundred eighty nine Pounds, sixteen Shillings, and six Pence; What is the Man indebted to you?

Suppose you are indebted to a Friend, two thousand four hundred ninety two Pounds, twelve Shillings, and six Pence; and you pay him in part at one time, three hundred twenty nine Pounds, ten Shillings; at another time, two hundred forty four Pounds, twelve Shillings, and six Pence; and at another time, ninety four Pounds: The Question is, What remains due to your Friend?

IX. If the Learner does put throughly understand what has been already taught in this and the foregoing Chapter, he will easily understand the manner of working the following Examples of Weights and Measures; there being no more difference between the working of these, and those already laid down, than only observing the Tables of each, which are already laid down in Chap. III.

X. *Subtraction of* Troy-Weight.

	l.	*oz.*	*dw.*	*gr.*	
Bought —	173	00	13	00	*Minorand.*
Sold —	78	04	16	15	*Subtrahend.*
Remains —	94	07	16	09	*Remainder.*
	173	00	13	00	*Proof.*

XI. *Sub-*

XI. *Subtraction of* Apothecaries Weight.

	℔	℥	ʒ	℈	*gr.*	
Bought--	12	04	3	0	00	*Minorand.*
Sold—---	08	05	1	1	15	*Subtrahend.*
Remains	3	11	1	1	05	
Proof—	12	04	3	0	00	

XII. *Subtraction of* Avoirdupois Weight.

	T.	*C.*	*Qr.*	*lb.*
Bought ——— ——	9	18	3	12
Sold——— ——— ———	7	19	3	24
Remains ——— ———	1	18	3	16
Proof——— ———	9	18	3	12

	l.	*oz.*	*dr.*
Bought——— ———	12	12	12
Sold ——— ———	8	14	15
Remains——— ———	3	13	13
Proof——— ———	12	12	12

XIII. *Subtraction of* Liquid Measure.

	Tuns.	*Hhds.*	*Gal.*
Bought——— ———	40	1	30
Sold ——— ———	16	1	40
Remains ——— ———	23	3	53
Proof ——— ———	40	1	30

XIV. *Subtraction of* Dry Measure.

	qurs.	*bush.*	*pec.*
Bought———— ————	10	0	0
Sold———— ————	5	5	2
Remains———— ————	4	2	2
Proof———— ————	10	0	0

XV. *Subtraction of* Cloth Measure.

	Yds.	*qurs.*	*Na.*
Bought———— ————	200	0	0
Sold ———— ————	149	3	2
Remains ————	50	0	2
Proof———— ————	200	0	0

XVI. *Subtraction of* Land Measure.

	A.	R.	P.
Bought———— ————	144	3	30
Sold ———— ————	86	3	34
Remains———— ————	57	3	36
Proof———— ————	144	3	30

CHAP. V.

CHAP. V.

Of MULTIPLICATION.

I. MUtiplication *is that* Rule by which we find the Increaſe or Amount of any Number, being ſo many times taken as there are Units in another Number.

II. This Increaſe or Amount is called the Fact, Rectangle, or Product; and the two Numbers producing it are called the Factors, the *leſſer* of which is called the Multiplier, and the *greater* is called the Multiplicand. As for example: If 12 were given to be multiplied by 2; I ſay 2 times 12 is 24. Here 2 and 12 (when ſpoken of together) are called the Factors; but when ſpoken of ſingly, 2 is the Multiplier, 12 the Multiplicand, and 24 the Product.

III. When you are perfect in the Terms (explain'd in the foregoing Section) you may then proceed; but firſt you muſt get by heart, the Product of any two of the nine Digits, (as 6 times 6, 7 times 8, 8 times 9, *&c.*) and this you may learn from the following

Table

Table of Multiplication.

1	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	6	9	12	15	18	21	24	27
4	8	12	16	20	24	28	32	36
5	10	15	20	25	30	35	40	45
6	12	18	24	30	36	42	48	54
7	14	21	28	35	42	49	56	63
8	16	24	32	40	48	56	64	72
9	18	27	36	45	54	63	72	81

This Table is commonly called *Pythagoras*'s Table, and tho' it be old-faſhion'd, yet (by the Experience of my Scholars) I find it to be better than the new-faſhion'd Tables now commonly made; for many Learners can readily tell you, that 6 times 7 (for inſtance) is 42, and yet they can't tell how many 7 times 6 is, (tho' it be the ſame) neither will theſe new Tables tell them; but here they have it both ways.

The Uſe of this Table is thus: Find the 2 Digits given to be multiply'd together, one in the upper Column of the Table, and the other in the firſt Column on the Left-hand, and in the Angle of meeting you have the Product. Thus the Table readily ſhews you that 5 times 8 is 40, 6 times 9 is 54, 7 times 8 is 56, and 8 times 9 is 72, and ſo of the reſt.

IV. When

IV. When you have got the foregoing Table perfectly by heart, you will ſoon learn the reſt of Multiplication, which is perform'd by this plain and general Rule.

Set down the Multiplicand, and under it the Multiplier, in ſuch order as has been taught in Addition and Subtraction, namely, Units under Units, Tens under Tens, *&c.* and draw a Line under them.

Then, *if the Multiplicand conſiſts of more places than one, and the Multiplier of but one Figure*; begin at the place of Units, and multiply the multiplier into every particular Figure of the Multiplicand, and ſo proceed towards the Left-hand, ſetting each particular Product (*if under* 10) under the Line in order as you proceed: But if any *particular Product* amounts to 10, or to juſt any certain Number of Tens, as 20, or 30, or 40, &c.) then ſet down a Cypher, and carry a Unit for every Ten to the Product of the next Figure; or if it amounts to above 10, or any certain number of Tens, ſet down the odd ones that are over and above Ten or Tens, and carry one for every Ten, as before. But here note, When you come to the laſt Figure of the Multiplicand, ſet down the whole Product of that Figure, let it be what it will.

Example.

I would multiply 871 by 6; or how many is 6 times 871?

Multiplicand———	871
Multiplier———	6
Product———	5226

The

The Numbers being placed according to the Rule, I begin, ſaying, 6 times 1 is 6, which (not amounting to 10) I ſet down under the Line, and proceed, ſaying, 6 times 7 is 42, (which being 2 above 4 tens, I ſay) 2 and go 4, that is, I ſet down 2, and carry 4 in my Mind to the next place; then I go on, ſaying, 6 times 8 is 48, and 4 that I carry is 52, which being the laſt place, I ſet it all down, and ſo the Work is finiſhed, and I find that 6 times 871 is 5226.

If you have more than one Figure in the Multiplier, the work is not much different from the former; for when you have multiply'd the firſt Figure of the Multiplyer into all the Multiplicand, as before directed, proceed to the ſecond and third, and all the reſt of the Figures of the Multiplier, multiplying each of them into the whole Multiplicand, and ſetting down their Products in ſo many particular Lines as you have Figures in the Multiplier. But here obſerve, always to ſet the firſt Figure (of each particular Product) under its proper Multiplier; and when you have done, draw a Line under the whole Work, and add their ſeveral Products together, and their Sum ſhall be the total Product requir'd. As in the following Example.

Let it be requir'd to multiply 643031 by 624, or how many is 624 times 643031?

Here

$$\begin{array}{r} 643031 \\ 624 \\ \hline 2572124 \\ 1286062 \\ 3858186 \\ \hline 401251344 \end{array}$$

Here in this Caſe I ſet down the given Numbers as before, and then I begin and multiply the whole Multiplicand by (the firſt Figure of the Multiplier) 4, ſaying, 4 times 1 is 4, which I ſet down under 4, and go on, ſaying, 4 times 3 is 12, 2 and go 1, (that is, I ſet down 2 and carry 1,) then, 4 times 0 is 0, and 1 that I carry is 1, which I ſet down and proceed, ſaying, 4 times 3 is 12, 2 and go 1; then 4 times 4 is 16, and 1 that I carry is 17, 7 and go 1; then laſtly, I ſay, 4 times 6 is 24, and one that I carry is 25, which I ſet down; and ſo the Product by the firſt Figure is 2572124. Then I go to the ſecond Figure of the Multiplier, ſaying, 2 times 1 is 2, which I ſet down (in a Line below the former) under 2 the Figure that I multiply by; then I go on, ſaying, 2 times 3 is 6, which I ſet down in the ſame Line, one place more to the Left Hand, and proceed, ſaying, 2 times 0 is 0, which I ſet down; then I ſay, 2 times 3 is 6, which I alſo ſet down; then I ſay, 2 times 4 is 8, which I ſet down alſo; and laſtly, I ſay, 2 times 6 is 12, which I ſet down likewiſe; ſo the Product by the ſecond Figure is 1286062. Then I go to the laſt Figure of the Multiplier, ſaying, 6 times 1 is 6, which I ſet down (in another Line below the other two) one place more towards the Left Hand than the firſt Figure of the former Line, namely, under 6, the Figure that I multiply by; then I go on, ſaying, 6 times 3 is 18, 8 and go 1; then 6 times 0 is 0, and 1 I carry is 1; then 6 times 3 is 18, 8 and go one; then 6 times 4 is 24, and 1 that I carry is 25, 5 and go 2; and laſtly, 6 times 6 is 36, and 2 that I carry is 38; ſo the

the Product by the third Figure of the Multiplier is 3858186. Then I draw a Line under theſe 3 particular Products, and add them up into one Sum, which I find to be 401251344, which is the true Product of 643031, multiply'd by 624, that is, 624 times 643031. See the Work in the Margin.

Note, There is no more difficulty in multiplying by *many* Figures than there is by *one*, if you do but obſerve to ſet the Firſt Figure of every particular Product exactly under that Figure of the Multiplier that you are multiplying by. Nevertheleſs, I ſhall lay down ſome.

More Examples for Practice.

```
     406345             620403
       4236              52314
  ----------        ----------
    2438070            2481612
   1219035             820403
   812690            1861209
  1625380           1240806
  ----------       3102015
  1721277420       -----------
                   32457762542
```

VI. The Proof of Multiplication is commonly by caſting away the 9's out of the Multiplier, Multiplicand, and Product; but this Proof being very erroneous, (many times proving the Work right when it is wrong,) I ſhall not here ſhew the Method of it.

The beſt proof of Multiplication is either by Diviſion, (of which Chap. vi.) or elſe by its own Rule Multiplication, thus: Change Places with the Multiplier and Multiplicand, and multiply all over

over again; and if this laſt Product be the ſame with the former, then was the former Work done right, elſe not.

Example.	*Proof.*
432	28
28	432
3456	56
864	84
	112
12096	12096

Here (in this Example) 432 multiply'd by 28, the Product is 12096; ſo (changing Places with the Multiplicand and Multiplier, as is done in the Proof) the Product of 28 multiply'd by 432, is alſo 12096. Wherefore I conclude the former Operation was done right.

VII. *Compendiums* in Multiplication.

Altho' the former Rules are ſufficient for all Caſes in Multiplication, yet becauſe in the Work of Multiplication, many times *great Labour may be ſav'd*, I ſhall acquaint the Learner with ſome brief Rules for that purpoſe, and that in the following Caſes.

Caſe 1.

When there are Cyphers intermixt with the Signifying Figures of the Multiplier.

In this Caſe multiply only the Signifying Figures, paſſing by the Cyphers as if there were none, only obſerving the Rule formerly taught, namely, always to ſet the firſt Figure of each particu

ticular Product, exactly under that Figure of the Multiplier that you multiply by. As in these Examples.

```
    24393          4268312
      402            40006
    -----      -----------
    48786         25609872
   97572        17073248
  -------      ------------
  9805986      170758089872
```

Case 2.

When the Multiplier ends with a Cypher or Cyphers.

In this Case I neglect the Cyphers, (as in the first Case) multiplying only the Signifying Figures; and when I have done, I annex the Cypher or Cyphers (in the Multiplier) to the Product; as in these Examples.

```
     4632           567234
      260              400
    -----        ---------
    27792        226893600
    9264
  -------
  1204330
```

Case 3.

When both the Multiplicand and Multiplyer end with Cyphers.

In this Case multiply as in the second Case, (omitting the Cyphers in each) and to the Product annex so many Cyphers as there are at the end of both the Multiplicand and Multiplyer, as in these Examples.

42600

42600	42300
220	12000
852	846
852	423
9372000	507600000

Note, In *this* and the foregoing Case I set the Signifying Figures of the Multiplyer level (on the Right Hand) with those of the Multicand.

Case 4.

When either the Multiplyer or Multiplicand, consisteth only of a Unit, and one or more Cyphers annexed; as 10, 100, 1000, *&c.*

In this Case, Annex those Cyphers to the other Number, and the Work is done; as in these Examples.

Multiplicand	6402	10000
Multiplyer	10000	425
Product	640200	4250000

VIII. Because many Men will not take Pains to learn either Vulgar Fractions or Decimals, yet have oftentimes occasion to multiply by a quarter, half, or three quarters; I shall therefore here shew how it may be done; namely thus, Having finished your Multiplication (by the Rules already taught,) take a quarter, half, or three quarters of the Multiplicand, and add it to the Product already found, and the Sum shall be the true Product sought.

Example.

Example.

Multiply 484
by 22 and a quarter.

968
968

Product 10648 by 22; then a quarter
of 484 is 121 which added
makes 10769 the true Product ſought.

IX. To multiply by any of the following Numbers in one Line, *viz.* 21, 31, 41, 51, 61, 71, 81, 91.

(Rule) Multiply each Figure in the Multiplicand by the Figure in the Tens place of the Multiplyer, and take in all the Multiplicand, excepting that Figure in the Units place, which you muſt ſet down (firſt or laſt) on the Right Hand of the Product.

For Example.

Multiply 4567 by 71 in one Line.

4567
71

32425

Here I ſay 7 times 7 is 49, and 6 (the ſecond Figure in the Multiplicand) is 55, 5 and carry 5; 7 times 6 is 42, and 5 (carry'd) is 47, and 5 (the third Figure in the Multiplicand) is 52, 2 and

and carry 5; 7 times 5 is 35, and 5 carry'd is 40, and 4 (the last Figure in the Multiplicand) is 44, 4 and carry 4; 7 times 4 is 28, and 4 carry'd is 32, which I set down as usual; and now the Unit Figure in the Multiplicand, namely 7, I place on the Right Hand of the Product, or you may put it down at the first beginning of the Work, as by the whole Operation following.

$$\begin{array}{r} 4567 \\ 71 \\ \hline 324257 \\ \hline \end{array}$$

X. To multiply by any of the Numbers in the last Section with a Cypher or Cyphers annext, as 210, 410, 7100, 810000, *&c.*

Set the o's down first (or last) and work as before.

Example.

$$\begin{array}{r} 4567 \\ 7100 \\ \hline 32425700 \\ \hline \end{array}$$

XI. How to multiply by these Numbers following in one Line, *viz.* 112, 113, 114, 115, 116, 117, 118, 119.

(Rule) Multiply each Figure of the Multiplicand by the Unit Figure of the Multiplyer, and to the Product of the Second Place (or Tens) add its single back Figure; and to the Product of all the rest, add the Sum of its 2 back Figures: An Example will make it plain.

Example.

Example. Multiply 2345 by 115 in one Line.

```
  2345
   115
------
269675
------
```

I say 5 times 5 is 25, 5 and carry 2; 5 times 4 is 20, and 2 carry'd is 22, and 5 (which is the single back Figure to 4) is 27, 7 and carry 2; 5 times 3 is 15, and 2 carry'd is 17, and 9 (the Sum of the 2 back Figures 4 and 5) makes 26, 6 and carry 2, 5 times 2 is 10, and 2 carry'd is 12, and 7 (the 2 back Figures 3 and 4 added) is 19, 9 and carry 1; then 1 carry'd and 5 (the 2 last Figures 2 and 3 added) is 6, which I set down, and 2 (the last Figure) is 2, to be placed last. See the whole Work repeated again.

```
  2345
   115
------
269675
------
```

If Cyphers are annext, set them down first, (or last) and work as before, as thus.

```
     2345
   115000
---------
269675000
---------
```

XII. To multiply by 211, 311, 411, 511, 611, 711, 811, 911 in one Line.

(Rule)

Rule) Set down the Unit Figure of the Multiplicand, and alſo the Sum of the firſt and ſecond Figures added (and carry the Tens to the next place if they ſhould make any,) then multiply all the Multiplicand by the Figure in the Hundreds place of the Multiplyer, and to each Product add the Sum of the 2 Figures ſtanding next before the Figure multiplyed.

Example.

$$\begin{array}{r} 4562 \\ 411 \\ \hline 1873982 \\ \hline \end{array}$$

Firſt I ſet down 2 (the Unit Figure,) and next to it I ſet down the Sum of the firſt and ſecond Figures (6 and 2 added) which is 8, then I proceed to multiply all the Multiplicand by 4 (the Figure in the Hundreds place of the Multiplyer) ſaying, 4 times 2 is 8, and 11 (which is the Sum of 6 and 5, the two Figures ſtanding next before 2 the Figure multiplyed) makes 19, 9 and carry 1; 4 times 6 is 24, and 1 carried is 25, and 9 (the Sum of the next two Figures before 6) is 34, 4 and carry 3; 4 times 5 is 20, and 3 is 23, and 4 (the only Figure before 5) is 27, 7 and carry 2; then 4 times 4 is 16, and 2 carry'd is 18, which I ſet down as uſual. See the Work above.

Queſtions to Exerciſe the Learner in Multiplication.

1. Multiply Seventy Four Thouſand Three Hundred Forty Nine by Four Hundred Ninety Six. *Anſwer.*

2. What is the Product of Three Millions Four Hundred Ninety Six Thousand, multiply'd by Seventeen Thousand Eight Hundred Seventy Nine?

Answer.

3. If Four Hundred Seventy Thousand Six Hundred Forty Eight be multiply'd by Ninety Thousand Eighty Six, What is the Product?

Answer.

4. How much is Ninety Eight Thousand times Ten Millions.

Answer.

CHAP. VI.

Of DIVISION.

I. DIvision is *that* Rule which teaches how to divide [or part] any given Number into what Number of equal Parts we please

Or, It is that Rule by which we discover how often [or how many times] one Number is contain'd in another.

II. In Division there are these 4 Terms to be learn'd; namely, the *Dividend*, the *Divisor*, the *Quotient*, and the *Remainder*. The *Dividend* is the Number given to be divided [or parted] into equal Parts. The *Divisor* is the Number given by which the Dividend is to be divided, and which shews into how many equal Parts the Dividend is to be divided. The *Quotient* is the Number found out by the Operation, and is so call'd,

call'd, becauſe it ſhews *how often* the Diviſor is contain'd in the Dividend The *Remainder* is the Number which remains after the Operation is ended.

Thus ſuppoſe 15 were given to be divided by 3, (or into 3 equal Parts) here 15 is the Dividend, 3 is the Diviſor, and 5 the Quotient, or one of thoſe 3 equal Parts that the Dividend is divided into. In this Example there was no Remainder, becauſe 3 is found in 15 juſt 5 times, without any thing remaining; but if you were to divide 20 by 3, the Quotient would be 6, and the Remainder 2; for 3 is contain'd in 20 6 times, and 2 remains over.

III. Having thus got a perfect Knowledge of the *Nature* of Diviſion, and of the *Terms* belonging to it; you may then proceed to the Operation [or Work] of Diviſion, which is perform'd by this Rule.

Firſt, Set down the Dividend, and draw a crooked Line at the Left Side thereof, behind which ſet the Diviſor. Draw alſo another crooked Line at the Right Side of the Dividend, for a Place for the Quotient to ſtand in.

For Example, Divide 636 by 3: The Numbers muſt be placed thus.

Dividend
Diviſor 3) 636 (Quotient.

If the Diviſor conſiſt but of one *Figure* (as in this Example) ſee whether the firſt Figure (namely that next the Left Hand) of the Dividend be as big as your Diviſor; if it be make a Point under it, which call the Dividual; but if it be not, then make your Point under the ſecond Figure of the Dividend; ſo the Dividual will (in this caſe) conſiſt of two Figures.

In the Example above I find the first Figure of the Dividend, namely 6, to be as big as the Divisor (3) therefore I make a Point under it as in the Margin.

```
          Dividend.
Divis. 3) 636 ( Quot.
          .
```

Having thus found my Dividual, I seek how often I can find the Divisor in the Dividual, and set that Figure in the Quotient; and by it multiply the Divisor, and set the Product under the Dividual, and (drawing a Line under it) substract it therefrom, setting the Remainder under the Line.

```
          Dividend.
Divis. 3) 636 (2 Quot.
          .
          6
          —
          0
```

For Instance in this Example, say 3 (the Divisor) I can find in 6 (the Dividual) twice or 2 times, therefore I set 2 in the Quotient, and by it I multiply the Divisor 3, and the Product is 6, which I set under 6, in the Dividend, and substract it therefrom, and there remains 0.

Then make a Point under the next Figure of the Dividend, and draw him down (that is, set that Figure down) to the Remainder; so the Remainder, together with the Figure thus drawn down, shall make a new Dividual.

```
          Dividend.
Divis. 3) 636 (2 Quot.
          ..
          6 .
          —
          03
```

As thus, I make a Point under the next Figure of the Dividend, (namely 3,) and I draw him down below the Line for a new Dividual. Then I proceed with this new Dividual, as I did with the former, finding another Figure to put in the Quotient.

That

That is, I ſay 3 (the Diviſor) I can find in 3 (the new Dividual) once therefore I ſet 1 in the Quotient, and by it I multiply the Diviſor, and the Product is 3, which I ſet under 3, and ſubſtract it from it, and there remains 0, which I ſet under the Line, and to it I bring down the next Figure, namely 6, for a new Dividual, as in the Margin.

```
             Dividend.
Diviſ. 3) 636 (21 Qu.
           ..
          6
          —
          03
           3
          —
          06
```

Then laſtly, 3 in 6 I can find twice, therefore I put 2 in the Quotient, and by it I multiply the Diviſor 3; ſo the Product is 6, which being ſet under 6, and ſubſtracted from it, there remains 0; ſo the Work is ended, and I find the Quotient to be 212; and ſo many times is 3 contain'd in 636, or 636 divided into 3 equal Parts, 212 is one of them.

```
             Dividend.
Diviſ. 3) 636 (212 Qu.
          ...
          6..
          ——
          03.
           3.
          ——
          06
           6
          ——
           0 Remaind.
```

If at any time the Diviſor be greater than the Dividual, then you muſt put a Cypher in the Quotient, and draw down another Figure to the Dividual.

Note this, as a Brief and General Rule in all kinds of Diviſion, whether the Diviſor conſiſt but of *one* or more Figures; namely, Firſt, to ſeek how often the Diviſor is contain'd in the Dividual; and ſecondly, (having put the Anſwer in the

Quotient) multiply the Diviſor thereby; and thirdly, ſubtract the Product from the Dividual; and fourthly, draw down the next Figure of the Dividend to the Remainder for a new Dividual. All which Operations, for Memory's ſake, may be comprized in this Diſtich.

Seek, ſet in Quote; multiply and ſubtract;
Draw down, and thus proceed, you'll be exact.

A few Examples will make this Rule plain to the meaneſt Capacities.

Example 1.

Let it be requir'd to divide 848 by 4, or into 4 equal Parts. Or how often is 4 contain'd in 848?

```
         Dividend.
Diviſ. 4) 848 (212 Qu.
          ...
          8..
          ---
          04.
           4.
          ---
          08
           8
          ---
           0 Remaind.
```

The given Numbers being ſet down as before directed, and as is here done in the Margin; I begin, ſaying, 4 I can find in 8 twice, or 2 times; therefore I ſet 2 in the Quotient, and by it I multiply the Diviſor 4, and the Product is 8, which I ſet under 8 in the Dividend, and ſubtract it therefrom, and there remains 0. Then I make a Point under the next Figure of the Dividend, (namely 4) and draw him down below the Line for a New Dividual. Then I work with this Dividual as with the former, ſaying, 4 I can find in 4 once; therefore I ſet 1 in the Quotient, and by it I multiply the Diviſor, and the Product is

is 4, which I ſet under 4, and ſubtract it from it, and there remains o, which I ſet under the Line, and to it I bring down the next Figure (namely 8) for a new Dividual. Then laſtly, I ſay, 4 in 8 I can find twice; therefore I put 2 in the Quotient, and by it I multiply the Diviſor, ſo the Product is 8, which being ſet under 8, and ſubtracted from it, there remains o; ſo the Work is ended, and I find the Quotient to be 212; and ſo many times is 4 contain'd in 848; or 848 divided into 4 equal Parts, 212 is one of them.

Example 2.

Again, If it were requir'd to divide 946 by 8, the Quotient would be 118. See the following Work.

```
8) 946 (118
   ...
   8 ..
   ----
   14 :
    8 :
   ----
   66
   64
   ----
    2 Remainder.
```

More Examples for Practice.

```
   Examp. 3.                         Examp. 4.
8) 84617 (10577                  9) 13908 (1545
    ...                               ...
   8:...                            9...
   -----                            -----
   046..                            49..
    40..                            45..
   -----                            -----
     61.                             40.
     56.                             36.
   -----                            -----
      57                              48
      56                              45
   -----                            -----
       1                               3
```

Here in this third Example, I cannot find the Divisor in (4) the second Dividend, and therefore I put a Cypher in the Quotient (according to the Rule laid down before) and bring down the next Figure (6) for a new Dividual, and then I proceed as before: Therefore here note once for all, (what I have already told you) That whenever you bring down a Figure, and cannot then find the Divisor in the Dividual, you must put a Cypher in the Quotient, and bring down another Figure for a new Dividual.

There is another way of dividing by one Figure, which is more short, and is this.

Example.

Divide 4857 by 3.

The given Numbers being placed as before, draw a Line under them thus.

3)

3) 4857

Then ſay how often, or how many times 3 which is the Diviſor, can you have in 4 (the firſt Figure towards the Left Hand of the Dividend) the Anſwer is once, which I place in the Quotient, exactly under the 4, as you ſee in the Margin, ſaying, take once 3 out of 4 and there remains 1, which 1 is 1 Ten to be added to the next Figure 8, which makes 18; then ſeek again, or ask how often 3 (the Diviſor) can you have in 18; the Anſwer is 6 times, which 6 place in the Quotient under 8, the ſecond Figure in the Dividend, and ſay, 6 times 3 is 18 out of 18, and there remains 0, (and here becauſe 0 remains, I have 0 to carry or add to the next Figure;) then ask again how many times 3 can I have in 5, the third Figure of the Dividend? *Anſw.* Once, which I place under 5, ſaying, once 3 is 3, out of 5, and there remains 2, which is 2 Tens (or Twenty) to be added to 7, the fourth and laſt Figure of the Dividend, and it will make 27. Then laſtly, ſeek how often the Diviſor 3 you can have in 27, the Anſwer is 9 times, which I place under 7, the laſt Figure of the Dividend, and the Work is done, as you may ſee in the Margin.

3) 4857
1

3) 4857
16

3) 4857
161

3) 4857
1619

More Examples done after the same manner.

4) 6725 (1	5) 7425	8) 8976
1681	1485	1122
6) 8274	7) 8974	9) 9987 (5
1379	1282	1108

Note, If the first Figure of the Dividend be less than the Divisor, then take the 2 first Figures of the Dividend, and proceed as before.

Example.

6) 4272 (

712

Note also, If any thing remain after the Divisor is ended, place it a little distance from the last Figure in the Quotient, with a crooked Line round it, as in the first and last Examples above.

IV. When you are perfect in dividing by one Figure, you may then proceed to divide by 2, 3, or more Figures; which Work is but little different from the other, and is thus perform'd.

First, Set down the Dividend and Divisor, as was directed in the foregoing 3d Section of this Chapter.

Then see how many Places of Figures you have in the Divisor, and take just so many of the first Figures of the Dividend, and make a Point

Point under the laſt of them to note your Dividual. Then conſider whether the Dividual be *bigger* or *leſs* than the Diviſor; for if it be *leſs*, then muſt you take one Figure more to your Dividual.

Having thus found your firſt Dividual, ſeek how often you can find the *firſt Figure* (next the Left Hand) of the Diviſor, in the *firſt Figure* of the Dividual, if they conſiſt of an equal Number of Figures; but if the Dividual have one Figure more than the Diviſor, then ſee how often you can have the *firſt Figure* of the Diviſor, in the 2 *firſt Figures* of the Dividual, and ſet the Anſwer in the Quotient; and by this Figure put in the Quotient, multiply the whole Diviſor, ſetting the Product under the Dividual, and ſubtracting it therefrom; and to the Remainder bring down the next Figure for a new Dividual. Proceed in the ſame manner till the Work be ended, for this is all the difference betwixt the dividing by one Figure and by many: I ſay, all the difference conſiſts in theſe 3 Particulars, namely, (1.) In finding the firſt Dividual (2.) In ſeeking how often the firſt Figure of the Diviſor is contain'd in the firſt, or 2 firſt Figures of the Dividual. And (3. In multiplying the whole Diviſor by the Figure put in the Quotient. A few Examples will make it plain.

Example 1.

Let it be requir'd to divide 9464 by 24.

Firſt, I put down the given Numbers as before directed: Then, becauſe the Diviſor conſiſts of 2 Figures, I put a Point under the ſecond Figure of the Dividend, namely under 4; then I ſeek how often I can find 2, (the firſt Figure of the Diviſor) in 9, (the firſt Figure of the Dividual,) the

Anſwer is 4 times, therefore I put 4 in the Quotient, and thereby multiply the whole Diviſor, and find the Product to be 96, which being greater than the Dividual, (94) I cancel the 4 put in the Quotient, and inſtead thereof I put 3, (a Unit leſs) and by it I multiply the Diviſor 24, and the Product is 72, which I ſet under, and ſubtract from (94) the Dividual, and there remains 22. Then I make a Point under the next Figure (namely 6) of the Dividend, and bring him down to the Remainder; ſo I have 226 for a new Dividual, and the Work will ſtand thus.

Diviſor.	Dividend.	Quotient.
24)	9464	(3
	72	
	226	

Then I go to the new Dividual, and becauſe he has one Figure more than the Diviſor, therefore I ſeek how often 2 (the firſt Figure of the Diviſor) is contain'd in 22 (the 2 firſt Figures of the Dividual) I ſay 9 times, (for I muſt never take it above 9 times, tho' I can) therefore I put 9 in the Quotient, and thereby multiply the Diviſor, and the Product is 216, which I ſet under the Dividual, and ſubtract it from it, and there remains 10; to which Remainder I bring down the next Figure of the Dividend, ſo my new Dividual is 104, and the Work will ſtand thus.

24)

24) 9464 (39
72
226
216
104

Then, this new Dividual being alſo one Figure more than the Diviſor, I ſeek how often I can find 2 in 10, which I can do 5 times; but multiplying my Diviſor by 5, the Product is 120, which is greater than the Dividual, and therefore I take it one leſs, and ſo put 4 in the Quotient, by which I multiply the Diviſor, and the Product is 96, which I ſet under, and ſubtract from the Dividual, and there remains 8; ſo the whole Work is ended, and will ſtand thus.

Diviſor.	Dividend.	Quotient.
24)	9464	394
	72	
	226	
	216	
	104	
	96	
	8 Remainder.	

V. Before I lay down any more Examples, I ſhall lay down the following Notes.

Note

Note 1. When at any time you have multiply'd the Divisor by the Figure last put in the Quotient, if then the Product be greater than the Dividual, then is that Figure put in the Quotient too big, and must be made less by a Unit; therefore cancel [or cross out] that Figure, and put another in his Room, one less than the former; and by this last Figure multiply the Divisor again, and if the Product be still greater than the Dividual, make the Figure in the Quotient yet less by a Unit: Thus do till your Product be less than the Dividual, or at least equal thereto, and then make Subtraction, and proceed as before.

2. Likewise, when you have multiply'd the Divisor by the Figure last put in the Quotient, and subtracted the Product from the Dividual; if then the Remainder be greater than the Divisor, then the Figure last put in the Quotient is too little, and must be made bigger, in the same manner as in the former Case it was made less; for the Remainder must never be greater than the Divisor.

3. That you must never put more than 9 in the Quotient at one time, tho' you can find the first Figure of the Divisor oftner in the first, or 2 first Figures of the Dividual.

4. That the *Remainder* after Division is ended, is always of the same Denomination with the Dividend. As suppose in the foregoing Example, the Dividend 9464 were so many Shillings, to be equally divided betwixt 24 Men; then the Quotient shews that each Man must have 394 Shillings and there is 8 Shillings over. Now, I say, the 8 that remains is of the same Denomination with the Dividend, namely, Shillings. If therefore these 8 Shillings were turn'd into Pence, (which is done by multiplying them by 12) they would be

be found equal to 96 Pence; which if you divide by 24, the Quotient is 4; so the exact Share of each Man would be 394*s.* 4*d.*

5. What is to be done with the Remainder after Division is ended, shall be shew'd in its due Place; but in the mean time the Learner ought to know, that it is the Numerator of a Fraction, and the Divisor is the Denominator of it, which Fraction is part of the Quotient; so the true Quotient of the last Example is 394 $\frac{8}{24}$, that is, (supposing it Shillings as in the 4th Note) 394*s.* and 8 Parts of 24 (or one third Part) of a Shilling, equal to 4*d.* as before.

VI. The Proof of Division is by Multiplication thus; Multiply the Quotient by the Divisor, and to the Product add the Remainder (if any be,) and if the Sum be the same with the Dividend, the Work is done right, else not.

Division may also be prov'd by Division, thus; Subtract the Remainder (if any be) from the Dividend, and divide the Remainder by the Quotient, and (if the Work be done right) this Quotient shall be equal to the Divisor.

The Ancient Proof by 9's I shall omit,
Because I know there is no Truth in it.

The following Examples I shall prove by Multiplication.

Example

Example 2.

```
385) 1183653 (3074          3074
         ....                385
     1155...              -------
     -------               15370
        2865.             24592
        2695.            9222
        -----            -------
         1703            1183490
         1540                163
        -----            -------
Remaind. (163)           1183653 Proof.
```

Example 3.

```
Divis. Dividend. Quot.
 587) 4763585  (8115
         ....                8115
      4696..                  587
      -------               -------
        675..               56805
        587..              64920
        -----             40575
         888.             ---------
         587.             4763505
         -----                 80
         3015             ---------
         2935             4763585 Proof.
         -----
Remaind. (80)
```

These Examples are sufficient to explain Division to the meanest Capacity.

VII. Compendiums in *Division*.

Many times the Work of Division may be very much shortned. For,

1. If

1. *If the Diviſor has one or more Cyphers on the Right-hand*, cut off ſo many Figures on the Right-hand of the Dividend, as there are Cyphers on the Right-hand of the Diviſor; and divide the remaining Figures of the Dividend, by the remaining Figure or Figures of the Diviſor: and to the Remainder annex thoſe Figures cut off from the Dividend. But if there be no Remainder, then thoſe Figures (alone) cut off from the Dividend ſhall be the Remainder.

Example.

Let it be requir'd to divide 46658 by 400. See here the Work.

```
4|00) 466|58 (116
      ...  ..
      4..  ..
      ---
       6.  ..
       4.  ..
      ---
       26  ..
       24  ..
      ---
Remainder (258)
```

2. *If the Diviſor conſiſt only of a Unit with Cyphers*, (as 10, 100, 1000, *&c.*) cut off ſo many Figures on the Right-hand of the Dividend as there are Cyphers in the Diviſor, and the Work is done: For thoſe Figures thus cut off are the Remainder, and the Figures remaining on the Left-hand are the Quotient.

Example.

Let it be requir'd to divide 4567891 by 1000. See the Work.

```
Quotient Remainder.
   4567|891
```

Here

Here are 3 Figures cut off from the Dividend, because there are so many Cyphers in the Divisor.

There is another way of Division (commonly call'd the short *Italian* way) wherein you multiply and subtract in your Mind, and set down only the Remainder. This Way is done by the following

Rule.

First begin to ask the Question (as before) how often the first Figure on the Right-hand of the Divisor is contain'd in the first Figure, (if it may be had) or else in the two first Figures of the Dividend; and set the Answer in the Quotient, with which Answer proceed to multiply the Unit Figure of the Divisor, and instead of setting down the Product (as in the other way) you bear it in mind, marking what Tens and Units are in this Product; and subtract it from the same Number of Tens as this Product makes, added to the Figure from whence you are to make your Subtraction in the Dividend (if it can be taken, but if not, add Ten more to it, and then take the said Product from it) and set down what remains, carrying all the Tens to the Product of the next Figure in the Divisor, and proceed as before. An Example or two will make it plain.

Example.

465) 19546 (

Here I should begin and say, how often 4 (the first Figure on the Right-hand of the Divisor) is contain'd in 1 (the first Figure in the Dividend) but because the Answer is 0, I say how often 4 is contain'd in 19 (the two first Figures of the Dividend)

dend) the Anſwer is 4, which I put in the Quotient (as in the Margin.) Then by this 4 in the Quotient I proceed to multiply 5 (the Unit Figure of the Diviſor) ſaying, 4 times 5 is 20, which Product, (inſtead of ſetting down as in the other way, I bear in mind, and ſubtract it from the ſame Number of Tens (as this Product makes, namely 20) added to the Figure from whence I am to make the Subtraction, namely 4, (the fourth Figure in the Dividend) that is, from 24, and there remains 4 (as in the Margin) and carry 2 (the Tens) to the Product of the next Figure of the Diviſor, ſaying, 4 times 6 (the ſecond Figure in the Diviſor) is 24, and 2 (that I carry) is 26; which Product I ſhould proceed to take from 25, (that is, the ſame Number of Tens as in the laſt Product added to 5, the third Figure in the Dividend) but I cannot, therefore I borrow Ten (as in the common Way of Subtraction) and add to 25 and it makes 35: Then I ſay 26 from 35, reſts 9, (as *per* Margin) and carry 3 (the Tens) to the next Figure of the Diviſor, ſaying, 4 times 4 (the firſt Figure of the Diviſor) is 16, and 3 (that I carry) is 19 from 19, reſts 0, ſo the whole Remainder is 94 (ſee the Margin) to which I bring down 6, the next Figure of the Dividend, and it makes 946 for a New Dividual (or Dividend) thus.

465) 19546 (4

465) 19546 (4
———
4

465) 19546 (4
———
94

465) 19546 (4
———
·94

465) 19546 (4
———
·946 New Dividend.

Then

Then I go on to repeat the ſame Work again, as before, and ask how often 4 (the firſt Figure of the Diviſor) can I have in 9, (the firſt Figure of the New Dividend) or (which is the ſame thing) how often 465 (the Diviſor) can I have in 946 (the Dividend) and the Anſwer is twice, (or 2 times) which 2 I put in the Quotient (as you ſee in the Margin,) and by it proceed to multiply the Unit Figure of the Diviſor, and ſubtract as before, ſaying, 2 times 5 is 10, from 16 (that is one Ten, as in the laſt Product added to the Unit Figure of the New Dividend) reſts 6, and carry 1 (the Ten) to the next Figure of the Diviſor, ſaying, 2 times 6 is 12, and 1 (I carry) is 13 from 14 (that is one Ten, as in the laſt Product added to 4, the ſecond Figure of the new Dividend) reſts 1 and carry 1 (the Ten) to the next Figure of the Diviſor, ſaying, 2 times 4 (the firſt Figure of the Diviſor) is 8, and 1 (I carry) is 9, from 9 (the firſt Figure in the New Dividend) reſts 0; ſo the laſt Remainder of the Diviſion is 16, as appears by the whole Operation in the Margin.

```
465) 19546 (42
     -----
       946
```

```
465) 19546 (42
     -----
       946 New Dividend.
       ---
         6
```

```
465) 19546 (42
     -----
       946 New Dividend.
       ---
        16
```

Dividend

Dividend.
Divisor 465) 19546 (42 Quotient.

946

16 Remainder.

More Examples of the short Italian *Way follow.*

Dividend.
Divisor 678) 74978 (22 Quotient.

1418

62 Remainder.

Dividend.
Divisor 8542) 9157897 (1072 Quotient.

61589

17957

873 Remainder.

Having now gone through both Ways of *Italian* Division, I leave the Learner to use that which seemeth best to him: But since the Design of this Treatise is chiefly intended for the meanest Capacity, I shall keep to the former Way, because I think it is less burthensome to an Ordinary Memory.

I could here proceed to shew the Reader 9 or 10 other different Ways of Division, but one or two good Ways is enough; and I love not to fill

a

a Learner's Head with too many Things at once, or to puzzle him with more than is needful.

Questions in Division.

Q. 1. Divide Three Hundred Forty Five Thousand, Nine Hundred Seventy Two, into Four Hundred Seventy Four equal Parts.

Answer,

Q. 2. If Eight Thousand Seven Hundred Thirty Eight Pounds be divided among Seven Hundred Ninety Four Men, What is each Man's Share?

Answer,

Q. 3. How often (or how many times) are Three Thousand Four Hundred Ninety Four, contain'd in Seven Millions, Eight Hundred Forty Nine Thousand, Two Hundred Ninety Nine?

Answer,

Thus have I done with the Five Principal Parts of Arithmetick, namely, *Numeration*, *Addition*, *Subtraction*, *Multiplication* and *Division*: And upon *these* all the following Rules (and all other Opperations whatsoever, that are possible to be wrought by Numbers) do immediately depend. Therefore I advise the Learner to practise, and be very perfect in those Rules, before he proceed any further.

CHAP.

CHAP. VII.

Of REDUCTION.

I. REduction is *that* Rule which teacheth how to bring a Number from one Denomination to another; as Pounds into Shillings, Shillings into Pence, *&c.*

It alſo teaches how to bring Numbers conſiſting each of 2 or more Denominations into one Denomination.

II. Reduction is of 2 Kinds, *Deſcending* and *Aſcending*.

III. Reduction Deſcending, is the bringing of Greater Denominations into Leſſer; as Pounds into Shillings, Shillings into Pence, *&c.* And this is done by Multiplication, by this

General Rule.

Conſider how many of the Leſſer Denomination are equal to one of the Greater, and multiply the given Number thereby; ſo the Product ſhall be the Anſwer to the Queſtion.

Example.

Reduce 8643 Shillings into Pence, or how many Pence are there in 8643 Shillings.

In

In 8643 Shillings, how many Pence.
12

17286
8643 *Answer*, 103716 Pence.

103716

Here I consider that 12 Pence is a Shilling, and that the Pence ought to be 12 times, the Number of Shillings; wherefore I multiply the given Number of Shillings by 12, and the Product is 103716 Pence, which is the Answer to the Question.

Reduction *ascending* is the bringing of Lesser Denominations into Greater; as Pence into Shillings, Shillings into Pounds, *&c.* and this is done by Division by this

General Rule.

Consider how many of the given Numbers are equal to *one* in *that* Denomination to which you would Reduce your given Number, and divide your given Number thereby; so the Quotient shall be the Answer requir'd.

Example.

In 103716 Pence how many Shillings.

Here I consider that 12 Pence is a Shilling, and that the Shillings ought to be but a Twelfth Part of the Pence; wherefore I divide the given Number of Pence by 12, and the Quotient is 8643 Shillings, which is the Answer to the Question. See the Work.

Pence

```
    Pence.  Shillings.
12) 103716 (8643
    96:..
    ----
     77..
     72..
    ----  Answ. 8643 Shillings.
      51.
      48.
      ---
       36
       36
       --
        0
```

I ſhall Illuſtrate theſe General Rules more particularly, by Examples of all the ſeveral Reductions of Money, Weights, and Meaſure commonly uſed amongſt us. In the doing of which you muſt always recal to your Mind the Note or Table of that Head we are treating of: My Meaning is when we are doing of Reduction of Money, you muſt remember the Note of the ſeveral Denominations of Money, namely, that 4 Farthings make a Penny, 12 Pence a Shilling, and 20 Shillings a Pound: So likewiſe in Reduction of Avoirdupois Weight, you muſt recollect the Note of that Weight, namely, that 16 Drams make an Ounce, 16 Ounces a Pound, 28 Pound a quarter of a Hundred, 4 quarters a Hundred, 20 Hundred a Tun: And ſo of the reſt of the Weights and Meaſures; all which are laid down in Addition, and therefore need not to be repeated again.

Having noticed this, I begin with Reduction of Money (or Coin) deſcending; to do which the beſt Way is to Reduce the given Number into the next leſſer Denomination, and from thence to

to the next lesser Denomination, and from thence to the next lesser, and so till you come to the Denomination requir'd.

Example.

In 586 Pounds, how many Shillings, Pence and Farthings.

```
              lib.
              586
Multiply by    20 the Shillings in a Pound.
            ------
     Makes  11720 Shillings.
Multiply by    12 the Pence in a Shilling.
            ------
            23440
           11720
            ------
     Makes 140640 Pence.
Multiply by     4 the Farthings in a Penny.
            ------
     Makes 562560 Farthings, for Answer.
```

Here I multiply the given Number 586 *l.* by 20 (because 20 Shillings make a Pound) to reduce them into the next lesser Denomination, namely, Shillings, and the Product is 11720 Shillings; Then I multiply the Shillings by 12 because 12 Pence is a Shilling) to reduce them into the next lesser Denomination to Shillings, namely, Pence, and the Product is 140640 Pence. Lastly, I multiply the Pence by 4 (because 4 Farthings is a Penny) to reduce them into the next lesser Denomination, namely, Farthings, and the Product is 562560 Farthings, as above.

When

When the given Number does not consist of divers Denominations, as Pounds, Shillings, and Pence, or Hundreds, Quarters, and Pounds, *&c.* It may be reduc'd into the Denomination requir'd at one Operation; so the given Number above, namely, 586 *l.* may be reduc'd into Pence or Farthings at one Work thus.

Multiply the given Number 586*l.* by 240 (because 240 Pence make a Pound) and the Product is Pence: See the Work following.

lb.
586
Multiply by 240 the Pence in a Pound.

23440
1172

Makes 140640 Pence.

Also Multiply 586 *l.* by 960 (because 960 Farthings make a Pound) and the Product will be Farthings, as followeth.

lb.
586
Multiply by 960 the Farthings in a Pound.

35160
5274

Makes 562560 Farthings.

Note, In Reduction Descending, whenever you would reduce a Number given to any Denomination requir'd at one Operation, you must first know the Number you are to multiply by,

(as in the 2 last Examples.) And since they are too many to be remember'd, I shall give you a General Rule to find out the Number you want, whenever you have occasion, whether it be in Money, Weight or Measure.

The Rule is this.

Take one of that Denomination the given Number is of, and Reduce it to the same Denomination which your Question is required to be brought into, and it will shew you the Number desir'd. For Instance,

If you would Reduce 245 *l.* into Farthings, and wanted to know the Number you must multiply by, to perform the Work at one Operation, according to the Rule,

lb. 1 20 20 *s.* 12 40 20 240 *d.* 4 960 *q.*	Take one of that Denomination the given Number is of, namely, 1 *l.* and reduce it to the same Denomination the Question is requir'd to be brought into, namely, Farthings, as in the Margin; so the Number is found to be 960, by which you must multiply the given Number 245, and the Product answers the Question at one Operation: The like is to be done in Weights and Measures.

Reduction of Money (*or* Coin) *Ascending.*

All Questions ascending (as told before) are wrought by Division.

Example.

In 562560 Farthings how many Pounds.

To do this Question, or any of this kind, I first divide the given Number, namely, 562560 Farthings

things by 4, and the Quotient is 140640 Pence; Then I divide the Pence by 12, and the Quotient is 11720 Shillings. Laſtly, I divide the Shillings by 20, and the Quotient is 586 Pounds. See the Work.

```
    q.       12)  d.       2|0 s.
4) 562560 (140640 (1172|0 (586 Pounds.
   4             12         10
   ——            ——         ——
   16            20         17
   16            12         16
   ——            ——         ——
    025           86         12
     24           84         12
    ——            ——         ——
      16           24
      16           24
     ——            ——
      00           00
```

Or, thus.

Farthings.

```
96|0) 56256|0 (586 Pounds.
      480
      ———
       825
       768
       ———
        576
        576
        ———
          0
```

I have wrought this Example 2 ways; in the firſt I have brought the given Farthings through

all the intermediate Denominations, reducing them first to the next Greater, and from thence to the next, and so on till I come to the Denomination requir'd, namely, Pounds. In the other way, I have brought the Farthings into Pounds at one Operation, by dividing them by as many Farthings as make a Pound, namely, 960.

Note, That to save removing my Dividends, I have set the Divisor at the top, where I have also set a Letter to note what Denomination each Number is; so I have written *q.* over the Farthings, *d.* over the Pence, and *s.* over the Shillings.

In Reduction Ascending, when you have a mind to perform the Work at one Operation, and want to know the Number to divide by, whether it be in Money, Weights or Measure. This is the

Rule.

Take one of that Denomination which the Question is requir'd to be brought into, and reduce it to the same Denomination the given Number is of, and Divide thereby, for Instance,

If you look back to the last Example, you will find the Denomination which the Question is requir'd to be brought into, is Pounds, and the Denomination given is Farthings: Now if I take 1 *l.* and reduce it into Farthings, it shews me the Number I am to divide by, namely, 960 (as was taught before,) the same may be understood in Weights and Measures.

When in Reduction descending the *Numbers given to be reduced consist of divers Denominations*, as Pounds, Shillings, and Pence; or Hundreds, Quarters and Pounds, *&c.* Then in this case, reduce the greatest Denomination into the next lesser,

fer (by the Rules already laid down) and add thereto the Number ſtanding in that Denomination which your greateſt Number is reduced to: Then reduce that Sum into the next leſſer Denomination, adding thereto the Number ſtanding in that Denomination: Do this till you have brought the given Number into the Denomination requir'd.

Example.

In 4327 *l.* 15 *s.* 11 *d.* 2 *q.* how many Shillings, Pence and Farthings.

	l.	*s.*	*d.*	*q.*
	4327	15	11	2

Multiply by 20 the Shillings in a Pound, and (add 15 *s.*

Makes 86555 Shillings.

Multiply by 12 the Pence in a Shilling, and (add 11 *d.*

173111
86556

Makes 1038671 Pence.

Multiply by 4 the Farthings in a Penny, and (add 2 *q.*

Makes 4154686 Farthings, for Anſwer.

Here I ſay, 0 times 7 is 0, but 5 (in the place of Units of Shillings) is 5, which I put down for the firſt Figure of the Product: Then, becauſe this Multiplyer is 0, I go no further with it, (for if I ſhould it would be all 0's) but proceed to the ſecond Figure of the Multiplyer, ſaying, 2 times 7 is 14, and 1 in the place of Tens of Shillings is 15; I ſet down 5, and carry 1 to the next place; and ſo I finiſh the Multiplication by the common Method, and find the Shillings in 4327 *l.* 15 *s.* to be 86555.

Then I proceed to bring the Shillings into Pence, by multiplying them by 12; and here I say, 2 times 5 is 10, and 1 (in the place of Units of Pence) is 11; I set down 1, and carry 1; and so on till I finish multiplying by 2. Then I go to the second Figure of the Multiplyer, namely, 1, saying, once 5 is 5, and 1 (in the place of Tens of Pence) is 6, which I set down, and then go on till I finish the Multiplication by the common Method, and the Product is 1038671 Pence.

Lastly, I proceed to bring the Pence into Farthings, by multiplying them by 4; and here I say, 4 times 1 is 4, and 2 (in the place of Farthings) is 6, which I set down, and go on till I finish the Multiplication by the common Method, and the Product is 4154686 Farthings in 4327 *l.* 15 *s.* 11 *d.* 2 *q.*

After this Method are all other Examples of the like Nature wrought.

Another Example *of the same.*

In 452 *l.* 17 *s.* 11 *d.* 3 *q.* how many Shillings, Pence, and Farthings.

	l.	*s.*	*d.*	*q.*	
	452	17	11	3	
Multiply by	20				the Shillings in a Pound, and (add 17 *s.*
	9057 *s.*				
Multiply by	12				the Pence in a Shilling, and (add 11 *d.*
	18115				
	9058				
	108695 *d.*				
Multiply by	4				the Farthings in a Penny, and (add 3 *q.*
	434783				Farthings.

In

In Reduction Ascending, if any thing remain after the Division is ended, it is always of the same Denomination with the Dividend, as in the following Example, which may serve as a Proof of the former.

In 434783 Farthings, how many Pounds, Shillings, Pence and Farthings.

```
    q.   12)  d.       2|0      l.   s.   d.   q.
4)  434783  (108695  (905|7  (452   17   11   3
    4....    108...   8.. :
    -----    ------   ----
    034...    069.    10. :
     32...     60.    10. .
    -----     ----    ----
       27.     95     05.
       24.     84      4.
      ----    ----    ----
       38     11 d.  17 s. Remainders.
       36
       --
       23
       20
       --
     3 q. remains.
```

Here you see in dividing the Farthings by 4, there remains 3, which is 3 Farthings: In dividng by 12, there remains 11, which is 11 Pence: In dividing by 20, there remains 17, which is 17 Shillings, which being gather'd together, and placed by the last Quotient, will make 452 *l.* 17 *s.* 11 *d.* 3 *q.* as you see the Work above, which is equal to the given Number of Farthings.

I have hitherto made use of that we call the long way of Multiplying and Dividing by 20, 12, and 4, by reason of its easiness for a Learner

as being not burthensome to the Memory; but now I shall shew you the short way which is very much practis'd of late. And since you will often have occasion to multiply and divide by 20, 12, and 4, you will find that this way will be very useful to shorten the Work.

1. To divide by 4 the short way has been already taught in Division by one Figure: However, in this place I shall give you another.

Example.

In 578 Farthings how many Pence.

4) 578 Farthings.

d. 144 (2

I begin and say, 4 I can have in 5 once; I set the 1 down under the 5, and say, once 4 out of 5 and there remains 1, which is 1 Ten to be added to the next Figure 7, and it makes 17: Then I say, 4 I can have in 17 four times; I set down 4 under the 7, and say, 4 times 4 is 16, out of 17, and there remains 1, which is 1 Ten, to be added to the next Figure 8, and it makes 18; Then 4 I can have in 18 four times, I set down 4 under 8, and say, 4 times 4 is 16, out of 18, and there remains 2, which is 2 Farthings.

Before you can multiply and divide by 12, the short way, you must learn the following Table by Heart.

12 Times

12 Times	2	is	24	
	3		36	
	4		48	
	5		60	
	6		72	
	7		84	
	8		96	
	9		108	

After this Table is got by heart, the manner of multiplying and dividing by 12 is the ſame as with a ſingle Figure.

2. To multiply by 12 the ſhort way.

Example.

In 654 Shillings how many Pence?

$$\begin{array}{r} s. \\ 654 \\ 12 \\ \hline 7848\ d. \end{array}$$

Here I ſay, 12 times 4 is 48, ſet down 8 and carry 4; 12 times 5 is 60, and 4 I carry'd, is 64, ſet down 4 and carry 6; 12 times 6 is 72, and 6 I carry'd is 78, which I ſet down: See the Work above.

3. To divide by 12 the ſhort way.

Example.

In 7848 Pence how many Shillings?

$$\begin{array}{r} d. \\ 12)\ 7848 \\ \hline 654\ \text{Shilli} \end{array}$$

I say 12 in 78 I can have 6 times; I set down 6 under 8, and say, 6 times 12 is 72, out of 78, and there remains 6, which is 6 Tens, or 60, to be added to the next Figure 4, and it makes 64: Then I say 12 I can have in 64 five times, I set down 5 under 4, and say 5 times 12 is 60, out of 64, and there remains 4, which is 4 Tens, or 40, to be added to the next Figure 8, and it makes 48; Then I say 12 I can have in 48 four times, I set down 4 under 8, and say, 4 times 12 is 48 out of 48, and nothing remains, as by the Work above.

4. To divide by 20 the short way.

Example.

Bring 11732 Shillings into Pounds.

2|0) 1173|2

li. 586—12 *s.*

Here I cut off one Place in the Dividend, and take half the rest, saying, half 11 is 5, and 1 remaining makes the next 17; then half 17 is 8, and 1 remaining makes the next 13; then half 13 is 6, and 1 remaining, which with the 2 cut off makes 12 *s.* for the Remainder, and the Quotient is 586 *l.* See the Work above.

Some Examples follow in Reduction of Money, Descending and Ascending, done after the short way.

1. Example Descending.

In 282 Pounds how many Shillings, Pence and Farthings

lib.

lib.
782
20
15640 Shillings.
12
187680 Pence.
4
750720 Farthings.

2. Example Aſcending.

In 750720 Farthings how many Pence Shillings and Pounds.

4) 750720 Farthings.

12) 187680 Pence.

2|0) 1564|0 Shillings.

Anſwer 782 Pounds.

This Sum proves the former.

3 Example Deſcending.

	l.	*s.*	*d.*	*q.*	
In	776	15	04	$\frac{3}{4}$	how many Farthings?
	20				
	15535 Shillings.				
	12				
	186424 Pence.				
	4				
	745699 Farthings.				

4 Example

4 Example Aſcending.

How many Pounds are there in 745699 Farthings?

4) 745699

12) 186424 $\frac{3}{4}$

20) 1553|5 : *d.*

Facit 776 *lb.* 15 *s.* 4 *d.* $\frac{3}{4}$ the Proof of the laſt Example.

To reduce Sterling [or *Engliſh* Money] into Foreign, and Foreign Coin into *Engliſh*.

1. To reduce *Engliſh* into Foreign Money.

The Rule.

Take the given Sterling, and alſo the Price of one of thoſe Pieces which the Sterling is to be brought into, and reduce them into one Name: Then divide one by the other, and the Quotient anſwers the Queſtion.

Example.

Example.

In 426 *l.* 14 *s.* 4 *d.* Sterling, how many Crowns of 57 *d.* $\frac{1}{4}$ *per* Crown.

```
lb.   s.  d.
426   14  4 Sterling.
 20
-----
8534 s.                    d.
  12                       57 1/4
------                      4
102412 d.                 -------
     4                    229 q.
------
229) 409648 (1788
     229::
     -----
     1806::
     1603::
     ------
     2034:          Answer, 1788 Crowns.
     1832:
     -----
      2028
      1832
      ----
       196
```

After the same manner are all the following Examples done.

1. In 721 *l.* 17 *s.* 10 *d.* how many Crowns at 58 *d.* $\frac{1}{2}$ *per* Crown?

2. In 461 *l.* 12 *s.* 07 *d.* how many Dollars at 4 *s.* 4 *d.* *per* Dollar?

3. In 2470 *l.* 10 *s.* 11 *d.* how many Guineas at 21 *s.* 6 *d.* *per* Guinea.

In

4. In 778 *l.* 18. 11 *d.* how many Crowns at 57 *d.* $\frac{3}{8}$ *per* Crown?

5. In 872 *l.* 17 *s.* 8 *d.* how many Pieces of $\frac{8}{8}$, at 4 *s.* 6 *d. per* Piece?

6. In 987 *l.* 19 *s.* 05 *d.* how many Rials of Plate at 4 *s.* 8 *d. per* Piece?

2. To reduce Foreign Coin in *English*.

The Rule.

Multiply the given Number of Foreign Pieces by the Pence or Farthings, *&c.* that are in the Price of one Piece, and it will shew you the Pence or Farthings in all the Pieces: Then Reduce one Pound Sterling into the same Denomination the Foreign Money is brought into, and divide thereby. The Quotient will give you the Pounds Sterling.

Example.

In 7426 Crowns, at 57 *d. per* Crown, how many Pounds Sterling.

```
                        7426                    s.
          Multiply by     57 the d. of }  20
                        ——— one Piece. }  12
                       51982               ——
                      37130               240 d.
                      —————          lb.
Divide by          }
240, the Pence     } 24|0) 42328|2 d. (1763
in a Pound.        }       24
                           ——
                           183
                           168   Answ. 1763 l. Sterl.
                           ———
                            152
                            144
                            ———
                              88
                              72
                              ——
                               6
```

The

The following Examples are done after the same manner.

1. In 7421 Crowns, at 58 *d.* $\frac{3}{4}$ *per* Crown, how many Pounds Sterling ?

2. In 7426 Guineas, at 21 *s.* 6 *d.* how many Pounds Sterling ?

3. In 64217 Pieces of Eight, at 4 *s.* 7 *d.* *per* Piece, how many Pounds Sterling ?

4. In 65742 Dollars, at 4 *s.* 6 *d.* *per* Dollar, how many *lb.* Sterling.

5. In 87256 Rials of Plate, at 4 *s.* 8 *d.* *per* Rial, how many Pounds Sterling ?

Having done with Reduction of Money, I shall now go on to the several Weights and Measures which are done after the same manner as this has been, only observing the Notes, and consider how many of one Denomination goes to make one of the next, and to multiply or divide accordingly.

Reduction of Avoirdupois-Weight, *Descending and Ascending.*

1 *Example Descending.*

In 742 C. how many *lb.*

```
             C.
            742
Multiply by   4  the Quarters in a Hundred.
   Makes   2968  Quarters.
Multiply by  28  the lb. in a quarter of C.
         ------
          23744
          5936
         ------
Makes     83104 lb. for Answer.
```

Or

Or at one Operation thus.

742 112 ——— 1484 742 742 ——— Makes 83104 *lb.*	The Number to Multiply by is found out by the Rule laid down in Reduction of Money thus, C. 1 4 — 4 *qu.* 28 ——— 112 *lb.*

It may not be improper to shew you here how To multiply by 112 in one Line, which is done by this Rule.

Multiply by 12, and take in each Figure of the Multiplicand, beginning to add the first (or Unit) Figure of the Multiplicand, to the Third or Hundreds of the Product, and so on, as was shewn before in Multiplication.

Example.

C.
Bring 7423 into Pounds.
112
———
831376 *lb.*

Say, 12 times 3 is 36, set down 6 and carry 3; then 12 times 2 is 24, and 3 carry'd, is 27, set down 7 and carry 2; 12 times 4 is 48, and 2 carry'd, is 50, and 3 (the first Figure of the Multiplicand) is 53, set down 3 and carry 5; 12 times 7 is 84, and 5 carry'd, is 89, and 2 (the second Figure of the Multiplicand) is 91, set down 1 and

and carry 9: Now 9 carry'd and 4 (the third Figure in the Multiplicand) is 13, set down 3 and carry 1; then 1 I carry'd and 7 (the last Figure of the Multiplicand) is 8: See the Work above.

2 Example Descending.

How many C. in 83104 *lb.*

```
      lb.  4)
  28) 83104   (2968
      56:::
      ----- Facit 742 C.
      271::
      252::
      -----
       190:
       168:
      -----
        224
        224
      -----
          0
```

Or at one Operation thus.

```
              C.
112) 83104 (742
     784
     ---
      470   The Numb.
      448   is found to
      ---   divide by,
       224  as before
       224  taught.
       ---
         0
```

These two Examples prove the former.

3 *Example*

3 *Example Descending.*

In 856 *C.* 3 *qu.* 17 *lb.* 2 *oz.* how many Ounces and Drams.

	C.	*qu.*	*lb.*	*oz.*
	856	3	17	2

Multiply by 4 the *qu.* in a *C.* and take in 3 *qu.*

Makes 3427 *qu.*
Multiply by 28 the *lb.* in a *qu.* of *C.* and take in (17 *lb.*

27423
6855

Makes 95973 *lb.*
Multiply by 16 the *oz.* in a *lb.* and take in 2 *oz.*

575840
95973

Makes 1535570 *oz.*
Multiply by 16 the Drams in an *oz.*

9213420
1535570

Makes 24569120 Drams.

4 *Example Ascending.*

How many Hundreds, Quarters, Pounds and Ounces are in 24569120 Drams?

```
    dr.  16)    oz.   28)  lb.  4)  qu.
16) 24569120 (1535570 (95973 (3427
    16          144       84     ----
    --          ---       --     856 (3/4
     85          95       119
     80          80       112
     --          --       ---
      56         155       77
      48         144       56
      --         ---       --
       89         117      213
       80         112      196
       --         ---      ---
        91         50      17 lb.
        80         48
        --         --
        112        2 oz.
        112
        ---
         00
```

Answer, 856 C. 3 *qu.* 17 *lb.* 2 *oz.* the Proof of the last.

5 *Example*

5 Example.

	C.	qu.	lb.
In 27 Hhds. each weighing	7	2	14
how many *oz.*	4		

I Reduce the Weight of 1 hhd. into the Denomination which the Question is requird to be brought into, namely, *oz.* and then multiply it by 27, the Number of hhds. and the Product shews the *oz.* of all the hhds. for Answer, as you see the Work.

30 *qu.*
28

244
61

854 *lb.*
16

5124
854

oz. 13664 in 1 hhd.
Mult. by 27 hhds.

95648
27328

Answ. 368928 *oz.* in all the Hhds.

6. In 472 C. 2 *qu.* 27 *lb.* how many Boxes, each 64 *lb.* 10 *oz.*

7. How many C. are in 4725 Boxes, each 57 *lb.* 12 *oz.*

8. In 874 C 3 *qu.* 19 *lb.* how many Hhds, each 8 C. 2 *qu.* 10 *lb.*

9. How many C. in 78241 hhd. each 10 C. $\frac{1}{4}$ 18 *lb.*

10. In 174 Piggs of Pewter, each 9 C. 2 *qu.* 10 *lb.* how many Pewter Dishes of 16 *lb.* 11 *oz.*

11. In

11. In 427 C. $\frac{1}{4}$ 19 *lb.* how many Chests of 5 C. $\frac{1}{4}$ 18 *lb.*

12. How many Piggs of Lead, each 12 C. $\frac{3}{4}$ 19 *lb.* must I buy to make 8 Leaden Cisterns, each 6 C. 2 *qu.* 12 *lb.*

Reduction of Troy-Weight, *Descending and Ascending.*

1 *Example Descending.*

In 742 *lb.* how many Grains?

	lb.	
	742	
Multiply by	12	the Ounces in a Pound Troy.
Makes	8904	Ounces.
Multiply by	20	the *dw.* in an Ounce.
Makes	178080	*dw.*
Multiply by	24	the Grains in a *dw.*
	712320	
	356160	
Makes	4273920	Grains for Answer.

Or at one Operation thus,

lb.

742

The

The Number is found (to multiply by) according to the Rule thus,

Note, It will sometimes happen that the Number you design to make your Multiplicand hath less Number of Figures than the Multiplier: In this Case (for Contraction sake) you may make the Multiplicand the Multiplier, Truth admitting of such a Change, as in this Example.

```
        lb.
         1
        12
        12 oz.
        20
       240 dw.
        24
       960
      480
      5760 Grains in a lb.
       742
     11520
    23040
   40320
Answer, 4273920 Grains in 742l.
```

2 Example Ascending.

How many *lb.* in 4273920 Grains?

```
24) 4273920  (17808|0 dw.
    24...2|0
    187    12)  8904  oz.
    168..
         Answ.  742   lb. or Proof of the last.
     193.
     192
      192
      132
       00
```

Or

Or at one Work thus.

```
      Grains.   lb.              lb.
5760) 4273920 (742 for Answ.     1
      40320..                    12
      -------                    ----
       24192.                    12 oz.
       23040.                    20
       ------                    ----
        11520                    240 dw.
        11520                    24
        -----                    ----
            0                    960
                                480
                                ----
                                5760 gr. in 1 lb.
```

These two last ways Ascending prove the two former Descending.

3 Example Descending.

In 49 Pounds, 11 Ounces, 19 Penny-weight, and 23 Grains *Troy*, how many Ounces, Penny-weight and Grains?

```
                  lb.   oz.   dw.  qu.
                  49 :  11 :  19 : 23
Multiply by       12 the oz. in a lb. and take in 11 oz.
                 ----
Makes            599 oz.
Multiply by       20 the dw. in an oz. and take in 19 dw.
               ------
Makes          11999 dw.
Multiply by       24 the gr. in a dw. and take in 23 gr.
              -------
               47999
              24000
              ------
              287992 Grains for Answer.
```

4 Example

4 *Example Ascending.*

How many Pounds, Ounces, Penny-weight and Grains are in 287999 Grains?

```
    Grains.
24) 287999 (11999|9 (
    24::   2|0
    ---    ------
       47: 12) 599   19 dw.
       24:  ---------
       ---  lb. 49   11 oz.
       239  ---------
       216
       ---
        239              lb.  oz.  dw.  gr.
        216        Answ. 49   11   19   23
        ---
        23 Grains.
```

Example 7.

In 12 Ing. of Silver, each how many Grains?

Bring the Weight of one Ingot into Grains, then multiply them by 12; the Number of Ingots, and the Product shews the Grains of all the Ingots for Answer.

```
  lb. oz. dw.
   3  10  14
  12
  ---
  46 oz.
  20
  ---
  934 dw.
   24
  ----
  3736
 1868
 -----
 22416 gr. in 1 Ingot.
    12 Ingots.
 ------
168992 gr. in all the Ing.
```

8 In

Qu. 8. In 18 Bars of Silver, each 4 *lb.* 11 *oz.* 10 *dw.* how many Grains?

Qu. 9. How many dozen of Silver Plates, each 9 *oz.* 17 *dw.* can be made out of 4 Ingots, each 5 *lb.* 8 *oz.* 19 *dw.*

Qu. 10. What Number of Mourning Rings, each 3 *dw.* 14 *gr.* can be made out of a Wedge of Gold weighing 4 *lb.* 11 *oz.* 15 *dw.* 17 *gr.*

Reduction of Cloth-Measure, *Descending and Ascending.*

Example 1.

In 42 Yards how many Nails.

4	Or thus,
168 qu.	42 Yards.
4	16 the Nails in a Yard.
672 Nails.	252
	42
	672 Nails.

Example 2.

How many Yards are in 672 Nails.

4) 672 Nails.	Or thus,
4) 168 Quarters.	16) 672 (42 Yards.
Facit 42 Yards.	64
	32
	32

Example 3.

In 74 Ells *English*, how many Nails ?

```
  74 Ells
   5
 ———
 370 Quarters.
   4
 ———
1480 Nails.
```

Or thus,

```
  74 Ells.
  20 the Nails in an Ell.
 ———
1480 Nails.
```

Example 4.

How many Ells *English* are in 1480 Nails ?

```
4) 1480 Nails.
   ———
5)  370 Quarters
   ———
Facit 74 Ells English.
   ———
```

Or thus,

```
2|0) 148|0
     ———
      74 Ells English.
     ———
```

Example 5.

In 89 Ells *Flemish*, how many Nails ?

```
  89 Ells
   3
 ———
 267 Quarters.
   4
 ———
1068 Nails.
```

Or thus,

```
  89 Ells Flemish.
  12 the Nails in an Ell Fl.
 ———
1068 Nails.
```

Example 6.

How many Ells *Flemish* in 1068 Nails ?

```
4) 1068 Nails.
   ———
3)  267 Quarters
   ———
Facit 89 Ells Flemish.
   ———
```

Or thus,

```
12) 1068 Nails.
    ———
Facit 89 Ells Flemish.
    ———
```

Exampl

Example 7.

In 47 Yards, 2 Quarters, 3 Nails, how many Quarters and Nails?

Yds.	*qu.*	*Nls.*
47	2	3
4		
190 qu.		
4		

Facit 763 Nails.

Example 8.

How many Yards, Quarters, and Nails in 763 Nails?

4) 763 (

4) 190 3 Nls.

Answ. Yds. 47 2 qu. 3 Nls.

Example 9.

In 426 Ells *English*, 3 Quarters, 3 Nails, how many Nails?

Ells Eng.	*qu.*	*Nls.*
426	3	
5		
2133 Quarters.		
4		

Answ. 8532 Nails.

Example 10.

How many Ells *English*, Quarters and Nails, are in 8515 Nails?

4) 8535 (

5) 2133 (3 *Nls.*

Facit Ells 426 3 *qu.* 3 *Nls.*

Example 11.

In 842 Ells *Flemish*, 2 Quarters, 2 Nails, how many Nails?

Ells Fl.	*qu.*	*Nls.*
842	2	2

3

2528 Quarters.

4

10114 Nails.

Example 12.

How many Ells *Flemish*, Quarters and Nails in 10114 Nails?

4) 10114 (

3) 2528 (2 Nails.

Facit Ells *Flemish* 842 2 qu. 2 Nls.

Example 13.

In 27 Pieces, each 28 *Yds.* 2 *qu.* 2 *Nls.* how many Nails?

Piece	The Measure of one Piece.
	Yds. *qu.* *Nls.*
27	28 2 2
Reduce the Measure of one Piece into Nails, then multiply by the Number of Pieces and the Product gives you the Nails in all the Pieces for Answer.	4
	114 qu.
	4
	458 Nls. in a Piece.
	27 Pieces.
	2806
	516
	7966 Nls. in 27 Pieces for Answer

14 In 274 Ells *Eng.* how many Ells *Flem.*
15 How many Ells *Eng.* in 74272 Ells *Flem.*
16 In 742 Yards, how many Ells *Eng.*
17 How many Yards in 7425 Ells *Eng.*
18 In 742 Ells *Flem.* how many Yards?
19 How many Ells *Flem.* in 7427 Yards?
20 How many Ells of Holland must I buy to make 8 Shirts, each 2 Yards $\frac{1}{2}$.
21 If it were requir'd to make 4 dozen of Napkins, each 1 Yard $\frac{1}{2}$. how many Ells *English* will make them?

Reduction of Liquid-Measure, *Descending and Ascending.*

Example 1.

In 742 Tons, how many Gallons?

```
   742 Tons.        Or thus,                Tons.
     4               742 Tons.                1
  ------             252                      4
  2968 Hhds.        ------                   ---
    63               1484                     4 Hhd.
  ------            3710                     63
  8904             1484                      ---
 17808             ------                    252 Gall.
 ------            186984 Gall.
 186984 Gall.
```

In 186984 Gallons, how many Tons?

```
           4)
63) 186984 (2968                    Or thus,
    126···  ----                              Tons.
    ------   742 Ton       252) 186984 (742
     609··                      1764··
     567··                      ------
     -----                       1058·
      428·                       1008·
      378·                       -----
      ----                        504
      504                         504
      504                         ---
      ---                          0
       0
```

Example

Example 2.

```
   Tons, Hhds. Gall.
In 654  :  3  :  28  how many Pints?
     4
   ----
   2619 Hhds.
     63
   ----
   7865
  15716
  ------
  165025 Gallons.
       8
 -------
1320200 Pints for Answer.
```

Example 3.

How many Tons, Hhds. and Gallons are in

```
8) 1320200 Pints.
   --------- 4)
63) 165025    (2619
    126...    ------
    ------ Tons 654  3 Hhds.  28 Gall.
     390..    ------
     378..
     -----
      122.
       63.
      ----
      595
      567
      ---
     28 Gallons.
```

Example 4.

5 How many Quart Bottles can I fill out of 3 Hhds. of Wine, each 63 Gallons?

5 In 74 Tons, how many Butts, Hhds. and Gall.

6 How many Tierces, each 42 Gallons, are in 7427 Hhds. of Wine ?

7 In 742 Hhds. of Beer, each 54 Gallons, how many Kilderkins, each 18 Gallons ?

8 In 744 Tons, and 742 Butts, each 126 Gall. and 742 Hhds. of Wine, each 63 Gallons, and 427 Tierces, each 42 Gallons, how many Quarts and Pints ?

Reduction of Land *or* Long-Measure, *Descending and Ascending.*

Example 1.

In 47 Miles how many Pole or Perches ?

8	Or thus,	Miles.
	47 Miles.	1
376 Furlongs.	320	8
40		
	940	8 Furl.
15040 Pole or Perches.	141	40
	Perches 15040	320Perches.

Example 2.

How many Miles are in 15040 Perches ?

Perches.	Or thus,
4|0) 1504|0	32|0) 1504|0 (47 Mil.
	128
8) 376 Furlongs.	
	224
47 Miles.	224

Example

Example 3.

How many Barley-corns will reach from *London* to *York*, being 150 Miles?

```
     150 Miles ?
       8
    ----
    1200 Furlongs.
      40
   -----
   48000 Perches.
      33
  ------
  144000
 144000
 -------
 1584000 half Feet.
       6
 -------
 9504000 Inches.
       3
 -------
```

Anſwer, 28512000 Barley-corns.

Example 4.

The Circumference of the Earth being 360 Degrees, and each Degree 60 *English* Miles, I demand how many Miles, Furlongs, Perches, Inches and Barley-corns will reach round the World?

```
       360 Degrees.
        60 Miles in a Degree.
     -----
     21600 Miles about the Earth.
         8 Furlongs in a Mile.
    ------
    172800 Furlongs about the Earth.
        40 Perches in a Furlong.
   -------
   6912000 Perches about the Earth.
        33 half Feet in a Perch.
  --------
  20736000
 20736000
 ---------
 228096000 half Feet about the Earth.
         6 Inches in a half Foot.
----------
1368576000 Inches about the Earth.
         3 Barley-corns in an Inch.
----------         Answer,
4105728000 Barley-corns about the Earth.
```

Reduction of Time *Descending and Ascending.*

1. In 35 Years, 123 Days, 21 Hours and 46 Minutes, how many Days, Hours and Minutes?

```
Years.  Days.  Hours.  Min.
  35     123     21     46
 365 Days in a Year.
 ----
 178
212
106
-----
12898 Days.
   24
-----
51593
25798
------
309573 Hours.
    60
--------
18574426 Minutes.
```

2. How many Years, Days, Hours and Minutes are in 18574426 Minutes?

```
6|0) 1857442|6 (46 Minutes.
                                     Days, Hours, Min.
           (365
24) 309573( 12898 (35 Years.  123     21     46
    24....  1095.
    ------  ----
     69...  1948
     48...  1825
     -----  ----
     215..  123 Days.
     192..
     -----
      237
      216
      ---
       213
       192
       ---
       21 Hours.
```

3 How

3. How many Days, Hours, and Minutes is it since the Birth of our Saviour *Jesus Christ*, to this present Year 1710?

```
    1710 Years.
     365 Days in a Year.
   -----
    8550
   10260
   5130
  ------
  624150 Days since the Birth of Christ.
      24
  -------
 2496600                            1710
1247570                                6
--------                           -----
14979600                           10260 Hours.
   10260 Hours added.
---------
14989860 Hours since the Birth of Christ.
      60
---------          Answer,
899391600 Minutes since the Birth of Christ.
```

Note, That reckoning but 365 Days to the Year, there is 6 Hours lost in every Year; to correct which you must multiply the Number of Years to be reduced by 6, and the Product will give you the Hours to be added, as you may see done in the Example above.

4. How many Minutes is it since the Reader was born?

5. Suppose our Saviour dy'd in the 45th Year of his Age, I demand how many Minutes he liv'd, and how many Minutes it is since he dy'd?

6. If the Tower of *London* was built 48 Years before our Saviour was born, how many Minutes is it since?

7. Admit

7. Admit it were 5807 Years since the World was made, how many Minutes is it since the Creation of the World?

Mixt Reduction *Descending.*

Reduce 57 *l.* 17 *s.* 10 *d.* into Pence; 52 *C.* $\frac{1}{4}$. 07 *lb.* into *lb.* weight; 25 *lb.* 11 *oz.* 10 *dw.* into *dw.*; 37 Yds. 3 qr. 2 Nls. into Nls.; 62 Hhds. 18 Gall. into Gall.; 75 Miles, 7 Furl. 27 Pole into Poles; 47 Years, 10 Months, 3 Weeks into Weeks

Descending.

l.	*s.*	*d.*	
57	17	10	into *d.*
20			
1157 *s.*			
12			
13894 *d.*			

C.		*lb.*	
52	$\frac{1}{4}$	07	into *lb.*
4			
209 *q.*			
28			
1679			
418			
5859 *lb.*			

l.	*oz.*	*dw.*	
25	11	10	into *dw.*
12			
311 *oz.*			
20			
6230 *dw.*			

Yds.	*q.*	*Nls.*	
37	2	3	into Nails.
4			
150 *q.*			
4			
603 *Nls.*			

Hhds.

Hhds.	*Gall.*		*Years.*	*Months.*	*Weeks.*
62	18 into Gall.		47	10	3
63			13		
194			151		
373			47		
3924 Gall.			621 Months.		
			4		
			2487 Weeks.		

Mixt Reduction *Ascending.*

Bring 13894 Pence into Pounds; 5859 Pounds Avoirdupois Weight into C. Weight; 6230 Penny-weight into Pounds Troy; 603 Nails into Yards; 3924 Gallons into Hogsheads; 2487 Weeks into Years.

d.
12) 13874 into *lb.*
2|0) 115|7 10 *d.*
l. 57 17 *s.* 10 *d.*

lb.
28) 5859 (into C.
56 (4)
209 (
259
252 C. 52 ¼ 07 *l.*
7 *l.*

dw.
2|0) 623|0 into *lb.*
12) 311 10 *dw.*
lb. 25 11 *oz.* 10 *dw.*

Nls.
4) 603 into Yds.
4) 150 3 Nls.
Yds. 37 2 *q.* 3 Nls.

Gallons

Gall.
63) 3924 (into Hhds.
378 : (62 hhd. 18 gal.

144
126

18 Gallons.

Weeks.
4) 2487 into Years.

13) 621 (3 Weeks.
52. (47 y. 10 m. 3 w.

101
91

10 Months.

Theſe two laſt Queſtions of Mixt Reduction Deſcending and Aſcending are promiſcuouſly propoſed as a brief Summary, or recalling to the Learner's Memory the ſeveral Reductions before laid down under diſtinct Heads.

CHAP. VIII.

Of the GOLDEN RULE, *or,* RULE OF THREE.

I. THIS Rule is call'd the *Golden Rule* from its Excellency, it being the moſt uſeful Rule in Arithmetick: And it is call'd the *Rule of Three* becauſe it has always three *Numbers* given, by the help of which to find out a fourth Number ſought. And

II. Theſe Numbers are commonly call'd Terms; as the firſt, ſecond, third, and fourth Term.

III. This Rule is of two Kinds, Single and Double.

IV. Again, Each of theſe is of two Kinds, Direct and Reverſe. I ſhall ſpeak of each in their Order, and firſt of the *Golden Rule Direct.*

V. The

V. The *Golden Rule direct* is when 3 Numbers are given to find out a fourth in a *Direct Proportion*; that is, when the *fourth* Term [or Number] ought to bear the same Proportion to the *third*, that the *second* doth to the *first*, or as the *first* Term is in proportion to the *second*, so is the *third* to the *fourth*, which may be better explain'd (in other Words) thus; when the *fourth* Term ought to contain the *third* just so many times as the *second* contains the *first*; or when the *fourth* Term ought to be contain'd by the *third* just as often as the *second* is contain'd by the *first*: This is call'd the Direct Rule, and is resolv'd thus.

VI. Multiply the *second* Term by the *third* (or which is the same thing) multiply the *third* Term by the *second*, and divide the Product by the *first*, the Quotient shall be the *fourth* Term sought, or Answer to the Question.

Example.

Quest. 1. If 4 Yards of Cloth cost 12 *s.* what will 6 Yards cost at that rate?

Yds.	*s.*	Yds.
If 4 cost	12	what costs 6
	6	(*Ans*. 18 *s.*
	—	
4)	72 (	
	—	
Answ.	18 *s.*	

Here I place the Numbers as in the Margin; then I multiply 12 by 6, and the Product is 72, which I divide by 4, and the Quotient is 18, which is the fourth Term sought, or Answ. to the Question.

Thus have I explain'd the Nature of the Golden Rule Direct, and shewn, in general, how to work it; but all the Difficulty in the Golden Rule lies in placing the 3 given Terms or Numbers in their right Order, fit for Work (for many

times

times the Queſtion is ſo intricately ſtated, as 'tis no eaſy matter to know which is the firſt Term, which the ſecond, and which the third.)

Therefore, when a queſtion is propos'd in the Golden Rule, the firſt thing you do muſt be to place the 3 given Terms, or Numbers, in their right order; that is, you muſt find which is your firſt Term, which your ſecond, and which your third. To do which you muſt know, That

Of the 3 Terms given, 2 of them are call'd *Terms of Suppoſition*, becauſe they ſuppoſe a Queſtion with its Anſwer; and the other Term is call'd the *Term of Demand*, becauſe it demands an Anſwer to a Queſtion: It is alſo eaſily known by theſe, or the like Words going before it, *How many, how much, what coſt*, &c.

This being known, let the *Term of Demand* be (always) the third Term; and of the 2 Terms remaining, let that which is of the ſame Denomination with the *Term of Demand* be the firſt Term, and then the remaining Term muſt be the ſecond Term, For

Example.

If 6 *lb.* of Sugar coſt 3 *s.* what coſts 9 *lb.*

In this Queſtion the Suppoſition is, if 6 *lb.* coſt 3 *s.* and the Demand is, what 9 *lb.* coſt: Now becauſe the Demand lies on the Number 9, therefore 9 muſt be the third Term, which for clearneſs ſake I put down

Thus.

1ſt. Term.	2d. Term.	3d. Term.
		lb.
		9

Here 9 being put, according to order, in the 3d. Term, I conſider next which of the other two Numbers is of the ſame kind or Nature with 9, that

that is, 9 being ſo many *lb.* weight, I muſt examine which of the other two Numbers bear the Denomination or Name of Weight, which I find does fall on the Number 6, that being *lb.* weight as well as the Number 9 is *lb.* weight, wherefore I place 6 in the firſt Term.

Thus,

1ſt. Term.	2d. Term.	3d. Term.
lb.		*lb.*
6		9

And then it conſequently follows, that the remaining Term 3 *s.* muſt be the ſecond Term, and then it will ſtand

Thus,

1ſt. Term.	2d. Term.	3d. Term.
lb.	*s.*	*lb.*
6	3	9

That is, If 6 *lb.* coſt 3 *s.* what coſt 9 *lb.*

Theſe things obſerv'd, you cannot miſs of placing the Terms right; which being done, the next thing is to know how to work it, (in order to find the Anſwer to the Queſtion) to do which This is the Rule.

Multiply the 2d. Term by the 3d. (or the 3d. by the 2d.) and divide the Product by the firſt; ſo the Quotient ſhall be the Anſwer to the Queſtion.

Example.

Q. 3. If 4 Yds. coſt 9 *s.* what coſt 8 Yds.

Multiply by 9 the 2d. Term.

Divide by the firſt Term 4) 72 (18 *s.* Anſw.
4
32
32
0

Or

Or thus,

If 4 Yards cost 9 *s.* what cost 8 Yds.
Multiply by 8 the 3d Term.

```
                          ——
Divide by the 1st Term 4) 72 (18 s. Answer.
                          4
                          ——
                          32
                          32
                          ——
                           0
```

Note, That the Answer to the Question (that is the Quotient of the Division by the first Term) is always in the same Denomination, or Name, that the second Term is of, or is reduced to; as you may see in the Example above, where you will find the Answer is 18, which is the same Name as the 2d Term (9) is of, that is, Shillings.

Many times the second Term (or Number) will consist of divers Denominations, as Pounds and Shillings, or Shillings and Pence, or Pounds, Shillings and Pence, *&c.* In this Case you must reduce it to the lowest Denomination mention'd, (or lower if you please) by Sect. 12 of Chap. 7. and then multiply and divide, as before directed.

Example.

Quest. 4. If 18 Yards of Camlet cost 3 *lb.* 12 *s.* what will 596 Yards cost at that rate?

Here the second Term consisting of divers Denominations, I reduce it to the least mention'd, namely, Shillings, and it makes 72 *s.* which I multiply by 596 (the 3d Term) and the Product is 42912, which being divided by 18 (the first Term) the

the Quotient is 2384 *s.* which is the 4th Term, or Anſwer to the Queſtion. See the whole Operation as followeth.

```
Yds.   lb. s.              Yds.
If 18 coſt 3 12 what coſt  596
           20               72
           --             ----
           72             1192
                          4172
                         -----     s.
                     18) 42912 (2384 Anſwer,
                         36...   which divide
                         --...   by 20, by cut-
                          69..   ting off the laſt
                          54..   Figure, and
                          --..   taking half the
                          151.   reſt makes
                          144.     lb.   s.
                          ---      119   4
                            72   for Anſwer.
                            72
                          ----
```

VII. It alſo many times happens in the Golden Rule, that tho' the firſt and third Terms be (as they muſt always be) of the ſame kind, (as, both Money, both Weighr, or both Meaſure, *&c.*) *Yet* either *one* or *both* of them may conſiſt of divers Denominations, (as was ſaid before of the 2d Term) In this caſe they muſt both be reduc'd to one Denomination, and that the leaſt mention'd, or lower if you pleaſe; which being done, multiply and divide as before directed.

Example.

Example.

Quest. 5. If 24 *lb.* of Raisins cost 8 *s.* what shall 1 C. 2 *q.* 24 *lb.* cost? Answer, 64 *s.* See the Operation.

	C.	*qu.*	*lb.*
If 24 *l.* cost 8 *s.* what cost	1	2	24

```
        4
       ---
        6 qu.
       28
      ----
       52
      14
     ----
     192 lb.
        8
    -----
24) 1536 (64 s. Answer.
    144
    ---
     96
     96
    ---
      0
```

Quest. 6. If 1 C. 1 *qu.* 13 *lb.* of Sugar cost 51 *s.* what will 6 C. 3 *qu.* 9 *lb.* cost at that rate. *Answ.* 255 *s.* See the Operation as follows.

C.

	C.	*qu.*	*lb.*		*s.*		C.	*q.*	*lb.*
If	1	1	13	cost	51	what cost	6	3	9
	4						4		
	5 *q.*						27 *q.*		
	28						28		
	43						225		
	11						54		
	153 *lb.*						765 *lb.*		
							51		
							765		
							3825		
						153)	39015	(255 *s. Ans.*	
							306..		
							841.		
							765.		
							765		
							765		
							0		

Sometimes it happens, that all the 3 (given) Terms consist of divers Denominations: In this case (also) they must each of them be reduced to the least Denomination mention'd; but be sure let the first and third Terms be reduced to the same Denomination; then work as before.

Example.

Quest. 7. If 3 C. 1 *q.* 14 *lb.* of Raisins cost 9 *lb.* 9 *s.* what will 6 C. 3 *q.* 20 *lb.* of the same cost? *Answer*, 19 *lb.* 8 *s.* See the Operation as follows.

If

```
    C. q. lb.        lb. s.              C. q. lb.
If  3  1  14   cost  9  9   what cost    6  3  20
    4                  20                4
   ---              -----               ---
    13 qr.           189 s.              27 qr.
    28                                   28
   ---                                  ---
   108                                  216
   27                                   56
   ---                                  ---
   378 lb.                              776 lb.
                                        189 s.
                                        ---
                                        6984
                                       6208
                                       776
                                     -------  2|0    lb. s.
                                378) 146664 (38|8 (19 8
                                     1134     2
                                     ----    --
                                      3326    18
                                      3024    18
                                      ----    --
                                       3024    0
                                       3024
                                       ----
                                          0
```

When you have multiply'd the *second* Term by the *third*, and divided the Product by the *first* Term: If then any thing remain after the Division is ended, it is part of a Unit in the Quotient, and its value may be found out thus.

Multiply the said Remainder by the Parts of the next lesser Denomination that are equal to a Unit in the Quotient, and divide the Product by the first Divisor, so the Quotient shall be the value of the said Remainder in the said Parts; and if any

any thing yet remain, multiply it by the Parts of the next lesser Denomination that are equal to a Unit in the last Quotient, and divide the Product by the same Divisor as before, so the Quotient shall be the value of the last Remainder in the last Parts. Proceed thus till you have brought it as low as you desire, and if any thing remain at the last of all, it is part of a Unit in the last Quotient, and must be placed over a Line, with the Divisor under it, as is done in the Question following.

Quest. 8. If 13 Yards of Velvet cost 21 *lb.* what will 27 Yards of the same cost at that rate? *Answ.* 43 *lb.* 12 *s.* 3 *d.* 2 *q.* $\frac{10}{13}$, that is, 43 Pounds 12 Shillings and 3 Pence 2 Farthings, and 10 Parts of 13 of a Farthing, which is a little above three quarters of a Farthing. See the Work as follows.

If

If 13 Yards cost 21 *lb.* what cost 27 Yards?

27

147
42

lb. *s.* *d.* *q.*

13) 567 (43 12 3 2 $\frac{10}{12}$.
52

47
39

8 Pounds remain.
20 Shillings in a Pound.

13) 160 (12 *s.*
13

30
26

4 Shillings remain.
12 Pence in a Shilling.

13) 48 (3 Pence.
39

9 Pence remain.
4 Farthings in a Penny.

13) 36 (2 *qu.*
26

10 $\frac{10}{13}$
7

Answer, 12 *s.* 3 *d.* 2 *q.* $\frac{10}{13}$.

Quest. 9. Bought 6 Hhds. of Tobacco, each weighing 5 *C.* 2 *q.* 17 *lb.* at 3 *l.* 10 *s.* 4 *d.* *per* *C.* what is the value of the 6 Hhds. at that rate?

To do this you must first find the Weight of the 6 Hhds. which is done by reducing the Weight of one of them into Pounds, and multiply them by 6 (the Number of Hhds) and they make 3798, *lb.* Then say, If 1 *C.* or 112 *lb.* cost 3 *l.* 10 *s.* 4 *d.* what will 633 *lb.* cost. *Answer,* 118 *l.* 13 *s.* 9 *d.* as by the Operation.

The Weight of 1 Hhd is 5 *C.* 2 *qu.* 17 *lb.*
Multiply by 4 qu. in a hundred.

Makes 22 *q.*
Multiply by 28 *lb.* in a qu. of a hund.

183
45

Makes 633 *lb.* weight of 1 Hhd.
Multiply by 6 Hhds the No. of Hdds.

Makes 3798 *lb.* in 6 Hhds.

Then say, *lb*

```
      lb.      l. s. d.              lb.
If 112 cost 3 10 4  what will 3798
            20                     840
           ----                 --------
            70 s.               151920
            12                 30384
           ----                ---------      d.
           140            112 (3190320 (28485
           70                  224...
           ----                -------
           840 d.               950...
                                896...
             2|0                -------
12) 28485 (237|3                 543..
    24...  ------                448..
    -----   118 13 9 d.        --------
     44..                         952.
     36..                         896.
    -----                       -------
      88.                           560
      84.                           560
     -----                       -------
       45                             0
       36                      lb.    s.   d.
     -----           Answer,   118    13   9
       9 d.
```

Quest. 10. What is the Amount of 8 Ingots of Silver, each weighing 4 *lb.* 10 *oz.* 12 *dw.* at 5 *s.* 2 *d. per oz.*

Reduce the Weight of 1 Ingot into the lowest Name mention'd, that is *dw.* and multiply them by 8 (the Number of Ingots) which will shew you the *dw.* in all the Ingots, as thus.

	lb.	oz.	dw.
The Weight of 1 Ingot is	4	10	12

Multiply by 12 *oz.* in a Pound.

Makes 58 *oz.*
Multiply by 20 *dw.* in an *oz.*

Makes 1160 *dw.* in 1 Ingot.
Multiply'd by 8 Ingots.

Makes 9280 *dw.* in 8 Ingots.

Then say,

	oz.		*s.*	*d.*		*dw.*
If	1	cost	5	2	what cost	9280
	20		12			62
	20 *dw.*		62 *d.*			18560
						55680

2|0) 57536|0 (28768 (239|7 — 119|7

57536	28768
4	24
17	47
16	36
15	116
14	108
13	88
12	84
16	4 *d.*
16	
0	

	lib.	*s.*	*d.*
Answer,	119	17	04

Ques

Quest. 11. Unto how much comes 12 Pieces of Holland, each Piece containing 27 Ells $\frac{1}{5}$, at 6 *s.* 6 *d. per* Ell. See the Work as follows.

Ells.
1 Piece contains 27 $\frac{1}{5}$
Multiply by 5 quarters in 1 Ell.

Makes 136 quarters in 1 Piece.
Multiply by 12 the Number of Pieces.

272
136

Makes 1632 quarters in all the Pieces.

Then say,

Ell. *s.* *d.* *quarters.*
If 1 cost 6 6, what will 1632 cost
5 12 78

5 *qr.* 78 *d.*

13056
11424

5) 127296 (25459
10

27
25

22
20

29
25

46
45

1

2|0
12) 25459 (233|8 (
24

l. *s.*
116 18

14
12

45
36

99
96

3 *d.*

l. *s.* *d.*
Ans. 116 18 3 $\frac{1}{5}$

Quest. 12. If a Hhd of Sugar, weighing 6 C. 3 *qrs.* 17 *lb.* cost 16 *l.* 18 *s.* 6 *d.* what will 1 *lb.* cost at that rate? See the Work.

```
   C. q. lb.       l.  s. d.          lb.
If 6  3  17 cost  16  18  6 what will 1 cost?
   4               20
   —               ——
   27 q.           338 s.
   28               12
   ———             ———
   223             682
   55              338
   ———             ———
   773 lb.                 d.  q.
            773) 4062 (5   2  42/773.
                 3665
                 ————
                  397
                    4
                 ————  q.
            773) 1588 (2    42/773.
                 1546
                 ————
                   42 Answer, 5 d. 2 q. 42/773.
```

Note, That to multiply or divide any Number by 1, is a needless Trouble, because it brings the Number that is multiply'd or divided by it to the same as it was before; for which reason in the Example above, I did not multiply the second Number 4062 by the third Number 1, because it would have made it the same, as you may see by the Work.

```
4062
   1
————
4062
```

The

The Golden Rule direct is thus prov'd, Multiply the first Term by the 4th, and note the Product; also multiply the second Term by the Third, and if this Product be equal to the former Product, then is the Work perform'd right, otherwise not, as in the first Question of this Chapter, namely,

If 4 Yards cost 12 *s.* what will 6 Yards cost? the Answer is 18 *s.*

Now the Product of 4 (the first Term) by 18 (the 4th Term) is 72, which is equal to the Product of 12 (the 2d Term) by 6 (the third Term) and therefore I conclude the Work is right. See the Operation.

Yds.	*s.*	Yds.	*s.*
If 4 cost	12	what cost 6, *Answ.*	18
	6		4
	72	equal to	72

Note, If any thing remain after Division by the Rule, that Remainder must be added to the Product of the first and 4th Terms, so the Sum will be equal to the Product of the other two Terms, if the Work be done right, else not.

Questions to Exercise the Learner in the Golden Rule Direct.

1. If 16 Ells cost 2 *l.* 14 *s.* 10 *d.* what cost 742 Ells?

2. To what comes 42 C. $\frac{3}{4}$ 14 *lb.* of Hops, at 1 *s.* 2 *d. per lb.*

3. What must I have for 27 *oz.* of Silver, at 5 *s.* 2 *d. per oz.*

 4. If

4. If Tobacco is 2 *s.* 4 *d. per lb.* what quantity can I buy for 100 Guineas?

5. At 2 *s.* 4 *d. per* Quart, unto how much comes 5 Pipes of Wine?

6. I demand the Amount of 84 Ells $\frac{1}{5}$ of Holland, at 6 *s.* 7 *d.* $\frac{1}{4}$ *per* Ell?

7. At 4 *l.* 17 *s.* 10 *d. per C.* how much will 47 C. $\frac{3}{4}$ 77 *lb.* amount to?

8. What is the Worth of 567 *C.* $\frac{3}{4}$ 10 *lb.* of Sugar, at 3 *l.* 12 *s.* 7 *d. per C.*

9. To how much comes 47 Barrels, each 5 C. $\frac{1}{4}$ 27 *lb.* at 4 *l.* 18 *s.* 9 *d. per C.*

10. What is the Amount of 18 Packs of Cloth, each 15 Pieces, at 12 *l.* 17 *s.* 4 *d. per* Piece?

11. I demand the Amount of 18 Butts of Currants, each 11 C. $\frac{3}{4}$ 19 *lb.* at 2 *l.* 18 *s.* 11 *d. per C.*

12. Sold 15 Hhds of *French* Wine, at 147 *l.* 15 *s. per* Ton: What doth the 15 Hhds amount to at that rate?

13. How many Yards of Muslin at 7 *s.* 6 *d. per* Yard, must I have for 150 *French* Crowns, at 57 *d.* $\frac{1}{4}$ *per* Crown?

14. Sold 47 Bales of Silk, each 17 *lb.* 11 *oz.* at 37 *s.* 10 *d.* $\frac{1}{4}$ *per l.* What do they amount to?

15. I demand the Amount of 1 C. when 20 Butts, each 14 C. $\frac{3}{4}$ 17 *lb.* cost me 560 *l.* 15 *s.* 6 *d.*

16. Sold 36 dozen, 8 Pair of Stockings, at 3 *s.* 6 *d. per* Pair, What do they amount to?

17. At 157 *l.* 17 *s.* 6 *d. per* Ton, What is that *per* Gallon?

18. What must I have for 35 Hhds of Sugar, each 4 C. $\frac{3}{4}$ 17 *lb.* to gain 3 *d.* $\frac{1}{2}$ *per lb.* when it cost me 6 *d.* $\frac{1}{4}$ *per lb.*

19. If Coffee be 8 *d.* $\frac{1}{4}$ *per oz.* What will 3 C. Weight cost at that rate?

20 Bought

20. Bought an Estate of 35 *l.* 10 *s.* *per Annum* after the rate of 18 Years $\frac{1}{4}$ Purchase, What comes it to?

21. How many Gallons of *French* Brandy, at 8 *s.* 6 *d.* *per* Gallon, shall I have for 36 dozen of Stockings, at 34 *d.* *per* Pair?

22 A Gentleman bought a piece of Land for 2500 *l.* how must he lett it *per Annum*, after the Rate of 20 Years Purchase.

23 If 120 Eggs are bought at 2 a Penny, and 120 more at 3 a Penny, and the same 240 sold again at 5 for 2 *d.* The Question is, What is gain'd or lost by them?

24. What Quantity of Tobacco, at 3 *l.* 17 *s.* 10 *d.* *per* C. can I have in Exchange for 27 Pieces of Broad Cloth, each Piece containing 38 Yards $\frac{1}{4}$ at 15 *s.* 6 *d* *per* Yard?

25. A Merchant hath owing him 748 *l.* 15 *s.* 10 *d.* and in part of Payment receiv'd 940 Dollars, at 4 *s.* 4 *d.* $\frac{1}{4}$ *per* Dollar, and 100 Pieces of $\frac{8}{8}$, each 4 *s.* 5 *d.* $\frac{3}{4}$, What remains unpaid of the Debt?

26. *A.* oweth to *B.* 250 *l.* 17 *s.* 6 *d.* to *C.* 427 *l.* 15 *s.* to *D.* 974 *l.* 18 *s.* 4 *d.* to *E* 867 *l.* 19 *s.* 10 *d.* And proving a Bankrupt, compoundeth with the Creditors for 5 *s.* 6 *d* in the Pound, I demand what each Man must receive, according to this Composition?

27. A Merchant bought 12 Butts of Currants, each weighing 10 C. $\frac{3}{4}$ 17 *lb.* at 2 *l.* 12 *s.* 4 *d.* *per* C. paid Custom 12 *s.* 6 *d.* *per* C. What cost the 12 Butts, and how must he sell them *per* C 50 *l.* by the whole?

28. Delivered to my Factor 7407 *l.* disposed of as followeth, (*viz.*) 20 Tobacco, at 3 *l.* 17 *s.* 6 *d.* *per* C. 890 gar, at 2 *l.* 12 *s.* 4 *d.* *per* C. the rest c

in Wine, at 52 *l.* 16 *s. per* Pipe. *Qu.* how much of each must be receiv'd ?

29. My Correspondent owes me 2784 Crowns, each 57 *d.* $\frac{1}{4}$. He hath remitted me 500 Crowns at 57 *d.* $\frac{3}{4}$ *per* Crown : I have drawn a Bill upon him for 300 Crowns, at 4 *s.* 6 *d.* $\frac{5}{8}$ *per* Crown : He hath sent me Goods, the Cost and Charges whereof are, as *per* Invoice, 740 Crowns, at 58 *d.* $\frac{1}{2}$ *per* Crown. Now Ballance this Accompt, and tell me what remains in his Hands, and how much Sterling Money it comes to the Exchange, at 55 *d.* $\frac{3}{4}$ *per* Crown ?

CHAP. IX.

Of the GOLDEN RULE REVERSE.

THE Golden Rule Reverse, is, when 3 Numbers are given, to find a fourth in a *reciprocal Proportion*, inverted to the Proportion given ; that is, when the *fourth* Term ought to bear the same Proportion to the *second* that the *first* doth to the *third* ; or as the *third* Term is in Proportion to the *first*, so is the *second* to the *fourth* ; which may be explain'd (in other Words) thus : When the *fourth* Term ought to contain the *second*, just so many times as the *first* contains the *third* ; or when the *fourth* Term ought to be contain'd by the *second*, just so often as the *first* is contain'd by the

This is call'd the Reverse Rule, and is re-
thus.

y the *first* Term by the *second*, (or, which
multiply the *second* Term by the *first*)
he Product by the *third* ; so the Quo-
be the *fourth* Term sought, or Answer
uestion.

Example.

Example.

Quest. 1. If 8 Men do a piece of Work in 12 Days, in how many Days ſhall 16 Men do the ſame piece of Work? *Anſwer*, 6 Days.

But before I proceed to the Work, it will be convenient for you to note, That in all the following Caſes you muſt do as in the Golden Rule Direct, (*viz.*)

(1) In placing the 3 Numbers, or Terms, in right order.

(2) In Reducing the firſt, 2d or 3d Terms (when the Queſtion requires it.)

(3) In the Quotient of your Diviſion, by the third Term (or Anſwer to the Queſtion, *&c.*)

(4) When any thing remains after Diviſion is ended.

I ſay, In all theſe Caſes you muſt obſerve the ſame Rules, and proceed after the ſame manner as taught before, in the Golden Rule Direct; or (which is the ſame thing) Note, That there is no other difference in the Proceedings of this Rule and the Golden Rule Direct than this,

That whereas in the Golden Rule Direct (when the 3 Terms are placed in right order) you multiply the 2d Term by the 3d (or the 3d by the 2d) and divide the Product by the firſt Term: ſo, contrariwiſe, in this Rule you multiply the firſt Term by the 2d (or the 2d by the firſt, as was ſaid before) and divide the Product by the 3d Term.

In all other things you follow the Direction laid down in the Golden Rule direct, (mention'd in the 4 Caſes above) except in the Proof of this Rule, which ſhall be taught in its proper Place.

Having

Having premis'd this, I proceed to the Operation of the Question proposed, which I shall here again rehearse.

Quest. If 8 Men do a piece of Work in 12 Days, in how many Days shall 16 Men do the same piece of Work? *Answer*, 6 Days. See the Work as followeth.

Men, Days, Men.
If 8 require 12 how many will 16 require?

```
        8
      ----
16) 96 (6
    96
   ----
     0    Answer, 6 Days.
```

Here I place the Numbers, as above, and then, (according to the Rule) I multiply 12 (the second Term) by 8 (the first Term) and the Product is 96, which I divide by 16 (the third Term) and the Quotient is 6, which is the 4th Term sought, or Answer to the Question.

When a Question is proposed in the Golden Rule, to know whether it is to be answer'd by the *Direct* or *Reverse* Rule; your Reason will tell you, if you observe the following Rule, namely,

If your Reason tell you, that the *bigger* the 3d Term is, the *bigger* the 4th Term must be: Or, That the *lesser* the 3d Term is, the *lesser* the 4th Term must be; then the Question is in the Direct Rule.

Example.

If 4 Yds. cost 9 *s.* what cost 8 Yds. *Answ.* 18 *s.*

Here in this Example, 8 the third Term is *bigger* than 4 the *first* Term; and Reason tells me, it

it will require a *bigger* Anſwer than the *firſt* Term; (for 8 Yards will coſt more than 4) therefore the *bigger* the 3d Term is, the *bigger* the 4th Term muſt be, (or more requires more) therefore this Queſtion is in the Direct Rule.

Again,

If 18 *s.* buy 8 Yards, how many will 9 *s.* buy? *Anſwer*, 4 Yards.

Here 9, the third Term, is leſs than 18, the firſt Term, and Reaſon tells me it will require a *leſs* Anſwer than the firſt Term, (for 9 *s.* will not buy ſo many Yards as 18 *s.*) therefore the *leſſer* the 3d Term is, the *leſſer* the 4th Term muſt be; (or leſs requires leſs,) therefore this Queſtion is alſo in the Direct Rule.

But if your Reaſon tell you, That the *bigger* the 3d Term is, the *leſſer* the 4th Term muſt be; or, That the *leſſer* the 3d Term is, the *bigger* the 4th Term muſt be; then the Queſtion is in the Reverſe Rule.

Example.

If 8 Men require 12 Days, how many will 16 Men require? *Anſw.* 6 Days.

Here 16, the third Term, is bigger than 8 the firſt Term; but Reaſon tells me it will require a leſſer Anſwer than the firſt Term: (for 16 Men will do the Work in leſs time than 8 Men,) therefore here the bigger the third Term is, the leſſer the 4th Term muſt be, (or more requires leſs;) therefore this Queſtion is in the Reverſe Rule.

Again,

If 12 Days require 8 Men, how many will 6 Days require? *Anſwer*, 16 Men.

In

In this Example, 6 the third Term, is less than 12 the first Term; yet Reason tells me, it will require a *bigger* Answer than the first Term, (for there must be more Men to do the Work in 6 Days than in 12,) therefore here the lesser the 3d Term is, the *bigger* the 4th Term must be, (or less requires more,) therefore this Question is also in the Reverse Rule.

These Rules (for the Memory's sake) may be comprized in the two following Distichs, *viz.*

If more *do* more, *or* less *do* less *respect*,
It is a Question in the Rule Direct:
But if more *wanteth* less, *or* less *wants* more,
The Question is Reverse *to that before.*

Quest. If 5 Men do a piece of Work in 11 Days, In how long time shall 9 Men do the same piece of Work? *Answer*, 6 Days, 2 Hours, 40 Minutes. See the Work as followeth.

Men, Days, Men,
If 5 require 11 how long will 9 require?

```
          5
        ——— D. H. M.
     9) 55 (6  2  40
        54
        —
         1 Day remain.
        24 Hours in a Day.
       ———
     9) 24 (2 h.
        18
        ——
         6 Hours remain.
        60 Minutes in an Hour.
       ———
     9) 360 (40 M.
        36
        00
```

Quest

Quest. How many Yards of Stuff, $\frac{1}{2}$ Ell wide, will line 12 Yards of Broad Cloth, 7 Quarters wide?

qu. broad,	Yds. long,	qu. broad.
If 7	12	2 $\frac{1}{2}$
2	14	2
14 $\frac{1}{2}$ qu.	48	5 $\frac{1}{2}$ qu.
	12	

5) 168 (33 Yds. 2 q. $\frac{3}{5}$ long, for *Answ.*
15:
18
15
3 Yards remain.
4
5) 12 (2
10
2

Quest. If when a Peck of Wheat cost 2 *s.* 9 *d.* the Penny-loaf weighed 9 *oz.* 10 *dw.* how much will it weigh when the Peck is worth 1 *s.* 10 *d.*

If

```
    s. d.          oz. dw.            s.  d.
If 2  9 require  9  10  what will  1  10 require?
   12              20                12
   ----            ----              ----
   33 d.           190 s.            22 d.
                    33
                   ----
                   570
                  570
                 ----- 2|0
            22) 6270 (23|9
                441   -----
               -----  oz.  dw.  gr.
                 87   11   19   13 2/22
                 66
                ----
                210
                198
                ----               oz.  dw   gr.
                 12  Anſwer,       11   19   13 2/22
                 24
                ----
                 48
                24
                ----
            22) 288 (13 gr.
                22
                ----
                 68
                 66
                ----
                  2
```

The Golden Rule Reverſe is prov'd thus,

Multiply the *firſt* Term by the *ſecond*, noting the Product; alſo multiply the *third* Term by the *fourth*; and if this Product be equal to the former, then is the Work done right, elſe not, as in Queſtion 1 of this Chapter.

If

If 8 Men do a piece of Work in 12 Days, in how many Days ſhall 16 Men do it? The Anſw. is 6 Days.

Now the Product of 8 (the firſt Term) by 12 (the ſecond Term) is equal to the Product of 16 (the third Term) by 6 (the fourth Term) and therefore I conclude the Work is right. See the Operation.

	Men,	Days,	Men,	
If	8 require	12 how many will	16 req.	*Anſw.* 6.
		8	6	
		96 equal to	96	

More Queſtions to Exerciſe the Learner in the Golden Rule Reverſe.

Queſt. 1. If 14 Gallons of Beer will ſerve 10 Men 8 Days, how long will it ſerve 15 Men?

Anſwer,

Q. 2. How much Shalloon, 3 quarters wide, is ſufficient to line a Coat which hath in it 3 Yards of Cloth 6 quarters wide?

Anſwer,

Q. 3. If the Governour of a Town, with 8000 Men in it is beſieged, and hath Proviſion of Victuals only for 4 Months, the Query is how many of his Men muſt he diſcharge that his Proviſions may laſt the remaining Number of Men 8 Months?

Anſwer,

Q. 4. How many Yards of 3 Foot wide, will cover a place that is 27 Foot long and 22 Foot broad?

Anſwer,

Queſt.

Q. 5. If I lend a Friend 500 *l.* for 4 Months (and having afterwards an occasion for the like Kindness) How much Money ought he to lend me again for 9 Months, to recompence the Courtesie I shew'd him?

Answer,

Q. 5. If 250 Men will dig a Trench (to cover the Soldiers from the Enemy) in 16 Hours, and there is a Necessity to have it done in 4 Hours, How many Workmen must there be imploy'd to do it in that time?

Answer,

Q. 6. If 140 *lb.* Weight will be carried 100 Miles for 11 *s.* 8 *d.* How many Miles will 1400 *lb.* Weight be carried for the same Money?

Answer,

Q. 6. If a Fortification was built by 240 Workmen in 10 Months, and being demolish'd it is requir'd to have it rebuilt in 2 Months, How many Men must there be appointed?

Answer,

CHAP. X.

Of the Double Rule of Three, *or* Golden Rule, *compos'd of Five Numbers.*

I. I Have been so large upon the *foregoing Rule,* (which some call the Single Rule of Three) that I may be the briefer in *this.*

II. This Rule has its Name from its having five Numbers given, to find a sixth in proportion thereunto, and is resolved by two single Rules of Three: But before you can work this Rule, you must know how

III. To

III. To dispose the given Terms (or Numbers) in their due Order and Place, fit for Work. For which this is

The Rule.

In all Questions in this Rule, there are five Terms (or Numbers) given, namely, 3 Terms of Supposition, and 2 of Demand. Of the 3 Terms of Supposition, let *that* which has the same Denomination with the Term requir'd, be placed in the second Place, and place the other 2 Terms of Supposition one over the other in the first Place, and then place the 2 Terms of Demand one over the other in the third Place; only observe to place Numbers of like Denomination in the same Rank, as two in the upper and two in the lower Rank, as in the following Example.

Qu. 1. If the Carriage of 100 *lb.* 30 Miles cost 1 *s.* what will the Carriage of 500 *lb.* cost, being carried 100 Miles?

In this Question, 100 *lb.* 30 Miles, and 1 *s.* are the 3 Terms of Supposition, (because it is suppos'd to be so) and 500 *lb.* and 100 Miles are the Terms of Demand; (because it is demanded what the Carriage of 500 *lb.* being carried 100 Miles will cost: Now, because 1 *s.* is of the same Denomination with the Term requir'd, (for it is requir'd to know how much, that is, how many Shillings the Carriage of 500 *lb.* 100 Miles will cost;) therefore 1 *s.* must be put in the second Place, and the other 2 Terms of Supposition must be set one over the other in the first Place, and the 2 Terms of Demand must be set one over another in the 3d Place: So the Numbers being placed according to the Rule will stand thus.

lib.

lb.		*s.*		*lb.*	
100	:	1	: :	500	:
M.				M.	
30	:			100	:

Having thus placed the given Terms (or Numbers) in their due Order ; then

IV. To resolve any Question in the Double Rule of Three, or Golden Rule, compos'd of 5 Numbers: This is

The Rule.

Say, As the first Term in the upper Rank is to the second, so is the third Term in the same Rank to a fourth. Again, As the first Term in the lower Rank is to the fourth last found, so is the other Term in the lower Rank to the Term required.

Note, Before you work these 2 Single Rules, you must be sure to find (by the Rule in Sect. 14. of Chap. 8) whether they are to be wrought by the *Direct* or *Reverse* Rule, and accordingly work them.

Thus, considering the foregoing Question, I find that both Parts of it are in the Direct Rule: Therefore I say, If the Carriage of 100 *lb.* (30 Miles) cost 1 *s.* What shall the Carriage of 500 *lb.* (the same distance) cost ? I multiply and divide, (according to the Rule in the foregoing Chap.) and find the Answer to be 5 *s.* Again, I say, If the Carriage of 500 *lb.* 30 Miles cost 5 *s* what shall the Carriage of the same Weight 100 Miles cost ? I multiply and divide, (as before) and find the Answer to be 16 *s.* 8 *d.* which is the Answer to the Question. See the Operation.

lib.

lb.		*s.*		*lb.*	
100	:	1	::	500	:
				1	

1|00) 5|00 (5 *s.*

	M.		*s.*		*M.*	
Again,	30	:	5	::	100	:
					5	

s. *d.*
3|0) 50|0 (16 8
3

20
18

2 *s.*
12

3) 24 (8 *d.*

V. You may alſo work the Double Rule of 3 at one Operation, thus.

Obſerve to place the given Terms, as is before taught in the 3d Section of this Chapter

Then, If the Queſtion be in the Double Rule of 3 Direct, (that is, if both the Single Rules are in the Golden Rule Direct ;) Multiply the 3 laſt Terms together for Dividend, and the 2 firſt for Diviſor, the Quotient ſhall be the Anſwer, as in the following Example.

Queſt. 2. If 14 Horſes eat 56 Buſhels of Oats in 16 Days, How many Buſhels will 20 Horſes eat in 24 Days? *Anſwer*, 120 Buſhels. See the Operation.

Horſes,

```
          Horses,  Bushels,  Horses,
            14   :   56   ::   20
     Days   16                 24 Days.
          ------            ------
            84                 80
            14                 40
          ------            ------
           224                480
                               56
                            ------
                             2880
                             2400 Bushels.
                           --------
                    224) 26880 (120 Answer.
                         224..
                        ------
                          448.
                          448.
                        ------
                          0000
```

VI. But if your Question be in the Double Rule of 3 Reverse, (that is, if one of the Single Rules be in the Golden Rule Reverse,) multiply the first, third, and fifth Numbers together for Dividend, and second and fourth for Divisor, as in the following Example.

Quest. 3. If 48 Pioneers, in 12 Days, cast a Trench 24 Yards long, How many Pioneers will cast a Trench 168 Yards long in 16 Days? *Answ.* 252 Pioneers. See the Operation.

Days,

```
     Days,  Pion.      Days,
      12  :  48  : :  16 :
Yards 24             168 Yards.
      16              48
     ----           -----
     144            1344
      24             672
     ----           -----
     384            8064
                      12
                  -------
                   16128
                   8064 Pioneers.
                  -------
            384)  96768 (252 the Answer.
                  768
                  -------
                   1996
                   1920
                  -------
                    768
                    768
                  -------
                    000
```

VI. The Proof of the Double Rule of Three is by proving each Single Rule, as is taught in the foregoing Chapter.

I have been ſo very large upon the foregoing Rules, that any ordinary Capacity may learn them without a Tutor; eſpecially if he do but obſerve the Rules laid down in my Advice to the Reader. And therefore I ſhall be very brief in the following Rules, becauſe they are all perform'd by ſome one or more of theſe.

CHAP.

CHAP. XI.

Of FELLOWSHIP.

I. FEllowship is when divers Persons trade together with one common Stock; and when they have gain'd or lost, *this Rule* shews how to find each Man's Proportional Part of the Gains or Loss.

II. Fellowship is either *Single* or *Double.*

III. Single Fellowship is when the Stocks proposed are Single Numbers, without any Relation to Time, each Partner continuing his Money in Stock for the same Time. This is resolved by the Golden Rule, thus.

Say, As the whole Stock is to the whole Gain or Loss, so is each Man's particular Stock to his particular Gain or Loss: Therefore work by the Golden Rule so many times as there are Partners.

Example.

Three Merchants, *A*, *B*, and *C*, make a joynt Adventure; *A* put into the common Stock 78 *l.* *B* put in 117 *l.* and *C* put in 234 *l.* With this Stock they trade till they have gain'd 2641 *l.* I demand each Man's Share of the Gains? Answ. *A* must have 48 *l.* *B* 72 *l.* and *C* 144 *l.* See the Operation.

	lb.						
A,	78	Then, As	429 :	264 :	78 :	48	*A.*
B,	117		429 :	264 :	117 :	72	*B.*
C,	234		429 :	264 :	234 :	144	*C.*
Sum	429				Whole Gain	264	

IV. Double

IV. Double Fellowship is when each Man's particular Stock has a Relation to a particular Time. In this Case the Rule is.

Multiply each Man's particular Stock into his Time, noting the Products. Then say, (by the Golden Rule) As the whole Sum of those Products is to the whole Gain or Loss, so is each Man's particular Product to his particular Gain or Loss.

Example.

Two Merchants, *A* and *B*, enter Partnership; *A* put in 40 *l.* for 3 Months; and *B* put in 75 *l.* for 4 Months, and they gained 70 *l.* I demand each Man's Share of the Gains, proportionable to his Stock and Time? Answer, *A* must have 20 *l.* and *B* 50 *l.* See the Operation.

40 Pound.	75 Pound.
3 Months.	4 Months.
A, 120 Product.	*B*, 300 Product.
	120
Sum of the Products,	420

$$\text{Then, As} \begin{cases} 420 : 70 :: 120 : 20 : A. \\ 420 : 70 :: 300 : 50 : B. \end{cases}$$

Proof, 70

CHAP. XII.

NUMERATION of VULGAR FRACTIONS.

I. A Fraction is part of a Unit [or one.]

II. A Fraction is exprest by 2 Numbers, one set over a Line and the other under the Line, thus, $\frac{1}{2}$.

III. A Fraction consists of 2 Parts, that above the Line, call'd the Numerator, and that under the Line, call'd the Denominator.

IV. The Denominator expresses the Number of equal Parts that a Unit [or one] is supposed to be divided into; and the Numerator shews how many of those Parts are signified by the Fraction.

Example.

This Fraction $\frac{5}{11}$ is to be read five Elevenths; (that is, 5 Parts of 11.) Here the Unit is suppos'd to be divided into eleven equal Parts, and this Fraction signifies five of them; so that $\frac{5}{11}$ is almost one half: In the same manner understand all other Fractions.

CHAP.

CHAP. XIII.

REDUCTION of VULGAR FRACTIONS.

I. TO Reduce a Mixt Number to an Improper Fraction.

The Rule is, Multiply the Integral Part, (or whole Number) by the Denominator of the Fractional Part; and to the Product add the Numerator, and that Sum place over the Denominator for a New Numerator; so this New Fraction shall be equal to the mixt Numbers given.

Example.

1. Reduce $16\frac{3}{7}$ to an Improper Fraction.

Here I multiply the whole Number 16 by 7 the Denominator, and to the Product add the Numerator 3, and the Sum is 115, which I put over the Denominator 7, and it makes $\frac{115}{7}$. See the Work in the Margin.

Whole Numb.	$16\frac{3}{7}$
Denominator	7
	115

Answer, $\frac{115}{7}$

More Examples.

2. Reduce $144\frac{12}{18}$ to an Improper Fraction.

Answer, $\frac{2604}{18}$

3. Reduce $74\frac{14}{19}$ to an Improper Fraction.

Answer, $\frac{1420}{19}$

4. What is the Improper Fraction of $88\frac{16}{24}$

Answer, $\frac{2128}{24}$

II. To reduce a whole Number to an Improper Fraction. The Rule is

Multiply the given Number by the intended Denominator, and set the Product for a Numerator over it.

Example.

1. Reduce 17 into a Fraction whose Denominator shall be 14.

To do which I multiply 17 by the intended Denominator 14, and the Product is 238, which I put over 14, as a Numerator, and it makes $\frac{238}{14}$ equal to 17. See the Work.

17
14 intended Denom.

68 *Facit* $\frac{238}{14}$ equal to 17. Otherwise let the
17 given Number be the Numerator and 1 the
Denominator. Thus 17 is $\frac{17}{1}$.

238

More Examples.

2. Reduce 48 into an Improper Fraction whose Denominator shall be 22.

Facit $\frac{1056}{22}$ or $\frac{48}{1}$

3. Reduce 142 into an Improper Fraction whose Denominator shall be 18.

Facit $\frac{2556}{18}$ or $\frac{142}{1}$

4. Reduce 472 into an Improper Fraction whose Denominator shall be 32.

Facit $\frac{15104}{32}$ or $\frac{472}{1}$

III. To Reduce an Improper Fraction to its Equivalent Whole or Mixt Number.

The

The Rule is, Divide the Numerator by the Denominator, the Quotient is the Whole Number equal to the Fraction; and if any thing remain, put it for a Numerator over the Divisor; so you have the Mixt Number equal to the Fraction.

Example.

1. Reduce $\frac{748}{7}$ into its Equivalent Mixt Number.

I divide 748, the Numerator, by 7, the Denominator, and the Quotient is 106, and there remains 4, which I place over the Divisor 7 for a Numerator, by the side of the Whole Number, and it makes $106\frac{6}{7}$, which is equal to $\frac{748}{7}$, the Improper Fraction given, as in the Margin.

```
7) 748 (106 6/7
   7
   ———
    48
    42 Answ. 106 6/7
   ———
     6 Equivalent to
           748/7
```

More Examples of the same.

2. Reduce $\frac{642}{9}$ to its Equivalent Mixt Number. Answer, $71\frac{3}{9}$

3. What is the Equivalent Mixt Number of the Improper Fraction $\frac{842}{34}$. Answer, $24\frac{26}{34}$

4. Find a Mixt Number equal to the Improper Fraction $\frac{6742}{464}$. Answer, $14\frac{246}{464}$

IV. To Reduce a Fraction to his lowest Terms, equal to the Fraction given.

The Rule.

If the Numbers of the Numerator and Denominator are even, take half of one, and half of the

the other, as often as you can; and when you can do ſo no longer (by reaſon one of them falls out to be an odd Number) then divide them either by 3, 4, 5, 6, 7, 8 or 9, which you find will divide them both without any Remainder; and when you have thus reduced them as low as you can, the given Fraction is then brought to his loweſt Terms, and is of the ſame Value that he was before.

Example.

1. Reduce $\frac{72}{144}$ into its loweſt Term.

72	36	18	9	3	1
144	72	36	18	6	2

Here becauſe both the Numerator and Denominator end in even Numbers, I find they may be reduc'd by 2, or 4, or 6, *&c.* Therefore (after drawing a long Line from it,) I firſt take the half of the Numerator, ſaying, the half of 72 is 36, for a New Numerator; alſo the half of 144 is 72, for a New Denominator: Again, the half of 36 is 18, for a New Numerator; alſo the half of 72 is 36, for a New Denominator: Once more, the half of 18 is 9, for a New Numerator, and the half of 36 is 18, of a New Denominator, ſo that now 'tis brought to $\frac{9}{18}$; and now I can go no lower by halving it, becauſe 9 is an uneven Number; wherefore I muſt try to divide them by 3, 4, 5, 6, 7, 8 or 9, and I find 3 or 9 will divide them both, which will bring them to $\frac{1}{2}$ equal to $\frac{72}{144}$.

More Examples follow.

2. Reduce $\frac{642}{898}$ into its loweſt Term. Anſw.
3. What is $\frac{274}{688}$ in its loweſt Term. Anſw.
4. Find the loweſt Term of $\frac{6824}{8474}$. Anſw.

Tho'

Tho' a Fraction cannot be brought into lower Terms for Operation, than by this 4th Rule, yet to help the Conception it may be thus.

Divide the Denominator by the greatest Number you can find will divide it exactly, without a Remainder, (tho' it will not divide the Numerator so) and put the Quotient for a New Denominator; and by the same Number divide the Numerator, putting the Quotient, with the Remainder, over the Divisor, for a Numerator, so the Numerator will be a Mixt Number: So $\frac{23}{24}$ (which is already in its lowest Terms) will be reduced to $\frac{5}{6}\frac{3}{4}$, that is, 5 parts of 6, and $\frac{3}{4}$ of a part.

See the Work in the Margin.

Here I divide the Denominator 24 by 4, and the Numerator 23 by 4, and the Quotients I set one over another, with the Remainder over the Divisor.

$$4)\ 24\ (6 \qquad \begin{array}{r} 24 \\ \hline 0 \end{array}$$

Facit $\dfrac{5\frac{3}{4}}{6}$

$$4)\ 23\ (5 \qquad \begin{array}{r} 20 \\ \hline 3 \end{array}$$

$\dfrac{5\frac{3}{4}}{6}$ Now to Reduce this compound Fraction to a simple one of the same Value, work thus, Multiply the Integral Part of the Numerator by the Denominator of the Fractional Part, and to the Product add the Numerator of the Fractional Part for a New Numerator; then multiply the Denominator of the Fraction by the Denominator of the Fractional Part of the Numerator for a New Denominator.

$5\frac{3}{4}$ Thus I multiply 5, the Integral Part
4 of the Numerator, by 4, the Denomina-
— tor of the Fractional Part, which makes
23 20, and add to it 3, the Numerator of the Fractional Part, and it makes 23 for a
6 New Numerator. Then I multiply 6,
4 the Denominator of the Fraction, by 4,
— the Denominator of the Fractional Part,
24 and it makes 24 for a New Denominator

Thus $\dfrac{5\frac{3}{4}}{6}$ is reduc'd to $\frac{23}{24}$.

There is yet another way to reduce a Fraction into its lowest Terms, that is, by finding the greatest Number that will divide both the Numerator and Denominator, and leave no Remainder (call'd a common Measure.) To find which Number

This is the Rule.

Divide the Denominator of the given Fraction by the Numerator, and if any thing remain, divide your Divisor by it; and should there any thing yet remain, divide your last Divisor by it, and so continue dividing the last Divisors by the Remainders, until there be no Remainder, (not minding the Quotient) so is the last Divisor the greatest common Measure unto the Number or Fraction given.

Example.

Reduce $\frac{91}{117}$ into its lowest Terms by a common Measure.

Here

Here I divide the Denominator 117 by the Numerator 91, and the Remainder is 26, by which I divide 91, and there remains 13, by which I divide 26, and nothing remains; wherefore the last Divisor 13 is the greatest common Measure unto the given Fraction $\frac{91}{117}$ (as you may see by the Work in the Margin)

```
91) 117 (1
    91
   ----
   26) 91 (3
       78
      ----
      13) 26 (2
          26
         ----
           0
```

by which Number (13) I divide the Numerator 91, and the Quotient is 7, for a New Numerator: Then I divide the Denominator 117 by 13, and it quotes 9 for a New Denominator. Thus have I found, (by a common Measure) $\frac{7}{9}$, which is equal to $\frac{71}{117}$.

Note, When the Numerator and Denominator have Cyphers at the end of each of them, you may cut off equal Cyphers in both, and shorten the Work. Thus $\frac{500}{600}$ by taking away, or cutting off the Cyphers, is speedily reduced to $\frac{5}{6}$, which is the same in Value with $\frac{500}{600}$. Also $\frac{7000}{9000}$ is reduced to $\frac{7}{9}$, and $\frac{400}{6000}$ to $\frac{4}{60}$.

V. To find the Value of a Fraction in the known Parts of Money, Weights and Measure.

The Rule.

Multiply the Numerator by the Parts o[f the] next lesser Denomination that are equal in[to] a Unit of the same Denomination w[ith the] Fraction; and divide the Product by [the Deno-]minator, and the Quotient gives you

in the same Parts you multiply by; and if any thing remain, multiply it by the Parts of the next lesser Denomination, and divide as before; so proceed till you can bring it no lower, and the several Quotients will give you the Value of the Fraction as was required; and if any thing at last remain, make it a Numerator to the former Denominator.

Example.

1. What is the Value of $\frac{38}{44}$ of a Pound Sterl. *Answ.* 17 *s.* 03 *d.* 1 *q.* $\frac{4}{44}$. See the Operation.

Multiply	38	the Numerator.
by	20	the Shillings in a Pound.
Divide by the Denom.	44) 760 (17 *s.*	
	44 :	
	320	
	308	
Remain	12	multiply'd.
by	12	the Pence in a Shilling.
	24	
	12	
	44) 144 (3 *d.*	
	132	
Remain	12	multiply'd.
by	4	the Farthings in a Penny.
	44) 48 (1 *q* $\frac{4}{44}$.	
	44	
Remain	4	

Example

Example 2.

What is the Value of $\frac{4}{12}$ of a Pound Troy?
Answ. 2 *oz.* 13 *dw.* 8 *gr.* equal to $\frac{4}{12}$ of a *lb.*

Multiply 4 the Numerator.
by 12 the Ounces in a Pound.

Divide by the Denominator. } 18) 48 (2 *oz.*
36

Remain 12 multiply'd.
by 20 the *dw.* in an Ounce.

18) 240 (13 *dw.*
18 :

60
54

Remain 6 multiply'd.
by 24 the Grains in a *dw.*

18) 144 (8 *gr.*
144

0

Example

Example 3.

What is the Value of $\frac{7}{8}$ of a Yard?

$$
\begin{array}{lrl}
 & \text{Numerator} & 7 \text{ multiply'd.} \\
 & \text{by} & \underline{4} \text{ quarters in a Yard.} \\
\text{Divided by the Denominator.} & 8) & 28\ (3 \text{ quarters.} \\
 & & \underline{24} \\
 & & 4 \text{ quarters remain multiply'd.} \\
 & \text{by} & \underline{4} \text{ Nails in a quarter.} \\
 & 8) & 16\ (2 \text{ Nails.} \\
 & & \underline{16} \\
 & & 0
\end{array}
$$

Answer, 3 qu. 2 Nails. equal to $\frac{7}{8}$ of a Yard.

VI. To Reduce a Compound Fraction to a Simple one of the ſame Value.

The Rule.

Multiply all the Numerators, one in another, for a New Numerator, and multiply all the Denominators, one in another, for a New Denominator.

Example

Example.

1. Reduce $\frac{4}{5}$ of $\frac{7}{8}$ of $\frac{8}{9}$ into a Simple Fraction.

I multiply 4, 7, and 8, one in another, and they make 224 for a New Numerator; alſo I multiply 5, 8, and 9, one in another, and the Product is 360 for a New Denominator, ſo the Simple Fraction is $\frac{224}{360}$, which is equivalent to $\frac{4}{5}$ of $\frac{7}{8}$ of $\frac{8}{9}$.

Numer.	Denom.
4	5
7	8
28	40
8	9
224	360
	Facit $\frac{224}{360}$

2. Reduce $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{8}{10}$ to a Simple Fraction. *Anſw.* $\frac{96}{200}$.

3. What is the Simple Fraction of $\frac{12}{13}$ of $\frac{16}{18}$ of $\frac{32}{48}$? *Anſw.* $\frac{6144}{11232}$.

Hence, to find the Value of a Compound Fraction, firſt reduce it to a Simple one, and then find its Value by Rule 5.

VII. To reduce Fractions of unequal Denominations to Fractions (of the ſame Value) having equal Denominations, which ſome call *Cognomina's*.

The Rule.

Multiply each Numerator by all the Denominators except his own, for New Numerators; then multiply all the Denominators, one in another, for a common Denominator to all the Numerators.

Example

Example.

Reduce $\frac{4}{5}$ $\frac{5}{6}$ and $\frac{7}{8}$ to a common Denominator. See the Work as followeth.

			all the Denom.
4	5	7	
6	5	6	5
			6
24	25	42	30
8	8	5	8
192	200	210	240

$$\left.\begin{matrix}\frac{192}{240}\\[1em]\frac{200}{240}\\[1em]\frac{210}{240}\end{matrix}\right\}\text{ equal to }\left\{\begin{matrix}\frac{4}{5}\\[1em]\frac{5}{6}\\[1em]\frac{7}{8}\end{matrix}\right.\text{ The three Fractions given.}$$

VIII. To Reduce a Fraction from one Denomination to another.

This is either Ascending or Descending; Ascending, when a Fraction of a *smaller* is brought to a *greater* Denomination:

And, Descending, when a Fraction of a greater Denomination is brought lower.

1. To Reduce a Fraction of a *smaller* to a greater Denomination, make of it a Compound Fraction, by comparing it with all the intermediate Parts between it and that you would reduce it to; then (by Rule 6) reduce it to a Simple Fraction.

Example

Example.

Reduce $\frac{4}{5}$ of a Penny to the Fraction of a Pound Sterling.

$\frac{4}{5}$ of $\frac{1}{12}$ of $\frac{1}{20}$

$$\begin{array}{r} 12 \\ 5 \\ \hline 60 \\ 20 \\ \hline 1200 \end{array}$$

$\frac{4}{1200}$ of a Pound, for Answer.

2. Reduce $\frac{1}{7}$ of an Ounce, *Avoirdupois* Weight, into the Fraction of a hundred Weight.

$\frac{1}{7}$ of $\frac{1}{16}$ of $\frac{1}{28}$ of $\frac{1}{4}$

$$\begin{array}{r} 16 \\ 7 \\ \hline 112 \\ 28 \\ \hline 896 \\ 224 \\ \hline 3136 \\ 4 \\ \hline 12544 \end{array}$$

Answer, $\frac{1}{12544}$ of a hundred

2. To reduce a Fraction of a greater to a Fraction of a lesser Denomination.

Rule.

Reduce the Numerator of the Fraction into that Denomination you would have your Fraction of, and place it over the Denominator of the given Fraction.

Example

Example.

Reduce $\frac{4}{1200}$ of a Pound to the Fraction of a Penny.

4
20
———
80
12
———
960

$\frac{960}{1200}$ Anſwer, which Fraction being reduced to its loweſt Terms (by Rule 4) is equal to $\frac{4}{5}$.

2. Reduce $\frac{1}{12544}$ of a hundred to the Fraction of an Ounce.

C.
1
4
———
4
28
———
112
16
———
672
112
———
1792

$\frac{1792}{12544}$ Anſwer, which in its loweſt Terms is $\frac{1}{7}$.

IX. To Reduce a Fraction from one Denomination to another. The Rule is, As the given Denominator is to his Numerator, ſo is the intended Denominator to his Numerator: Thus $\frac{3}{4}$ will be found to be $\frac{15}{20}$, or 15 parts of 20.

CHAP.

CHAP. XIV.

ADDITION of VULGAR FRACTIONS.

I. RULE. If the Fractions to be added are *Cognomina's*, [that is, if they have a common Denomination,] add their Numerators together, for a New Numerator to the common Denominator: This new Fraction shall be equal to the Sum of the given Fraction. If this Sum be an Improper Fraction, reduce it to a whole or mixt Number, by Rule 3 of the last Chapter.

Example.

To $\frac{4}{12}$ add $\frac{7}{12}$ $\frac{9}{12}$ and $\frac{11}{12}$

Numerators.

$$\text{Add}\left\{\begin{array}{r} 4 \\ 7 \\ 9 \\ 11 \end{array}\right.$$

$$\overline{31}$$

Answer, $\frac{31}{12}$, the Sum of the given Fraction, which being an Improper Fraction, will be reduced to the mixt Number $2\,\frac{7}{12}$.

Rule II. If the Fractions have unequal Denominators, reduce them to *Cognomina's* (by Rule 7. of the last Chap.) and then proceed as before.

Example.

What is the Sum of $\frac{3}{4}$ $\frac{7}{5}$ and $\frac{5}{6}$?

The Fractions in a common Denominator are $\frac{90}{120}$ $\frac{96}{120}$ and $\frac{100}{120}$. Their Numerators added together, make 286 for a new Numerator to the common

common Denominator 120. Thus $\frac{286}{120}$ equal to the mixt Number 2 $\frac{46}{120}$, or 2 $\frac{23}{60}$.

III. If mixt Numbers are to be added together, The Rule is

Work with the Fractional Parts, as before, then add the Sum of the Fractions to the Sum of the Integers, and it is done.

Example.

What is the Sum of 6 $\frac{1}{2}$ and 34 $\frac{3}{5}$?

The Sum of the Fraction by the last Example is 1 $\frac{1}{10}$, which being added to 6 and 34 makes 41 $\frac{1}{10}$.

$$\begin{array}{r l} 1 & \frac{1}{10} \\ 6 & \\ 34 & \\ \hline \end{array}$$

Answer, 41 $\frac{1}{10}$, the Sum required.

IV. When any of the Fractions to be added are Compound Fractions, Reduce the Compound Fraction to a Simple one (by Rule 6. of the last Chap.) then find the Sum by the first Rule of this Chapter.

Example.

To $\frac{14}{27}$ add $\frac{3}{4}$ of $\frac{4}{5}$.

The Compound Fraction $\frac{3}{4}$ of $\frac{4}{5}$, reduced to a Simple one, are $\frac{12}{20}$ or $\frac{3}{5}$.

The Common Denominator of $\frac{3}{5}$ and $\frac{14}{27}$ is $\frac{81}{135}$ and $\frac{70}{135}$ the Sum of the Numerators, is 151, and the Sum of the given Fractions is $\frac{151}{135}$.

V. When the Fractions to be added are not of one Denomination, they must be reduc'd to one and the same Name (by Rule 8 of the last Chap.) and then proceed as before.

Example

Example.

To $\frac{4}{5}$ *lb.* add $\frac{7}{8}$ *s.*

Here one of the Fractions is of a Pound, and the other of a Shilling; and before I can add them, I must reduce $\frac{7}{8}$ *s.* to the same Name as the other is, namely, the Fraction of a Pound (by Rule 8 of the last Chap.) and it makes $\frac{7}{160}$ *lb.* then $\frac{4}{5}$ *lb.* and $\frac{7}{160}$ *lb.* will be found to be $\frac{640}{800}$, or $\frac{64}{80}$ (by the Rule 7) or $\frac{4}{5}$ (by Rule 4)

CHAP. XV.

SUBTRACTION of VULGAR FRACTIONS.

I. TO Subtract one Fraction from another.

The Rule is,

As in Addition, so here, before Subtraction can be perform'd, the given Fractions must be reduced (if they require it) to the same Denomination and Denominator: Then subtract one Numerator from the other, and the Remainder shall be a new Numerator to the Common Denominator, which new Fraction shall be the Excess or Difference between the given Fraction.

Example 1.

Subtract $\frac{4}{5}$ from $\frac{7}{8}$.

The 2 Fractions being reduced to $\frac{32}{40}$ and $\frac{35}{40}$, I subtract the Numerators 32 from 35, and there remains

remains 3, which I ſet over the Common Denominator 40 for a Remainder: Thus $\frac{3}{40}$ the Difference between $\frac{4}{5}$ and $\frac{7}{8}$.

Example 2.

Subtract $\frac{2}{4}$ and $\frac{4}{6}$ from $\frac{7}{8}$ and $\frac{9}{10}$.

Becauſe the Denominations are different, I reduce them into one Denomination, and they make $\frac{960}{1920}$, $\frac{1280}{1920}$, $\frac{1680}{1920}$, $\frac{1728}{1920}$. Then I add the Numerators of the two firſt together, and they make $\frac{2240}{1920}$; alſo I add the Numerators of the two laſt, and they make $\frac{3408}{1920}$: Then I ſubtract the Numerator 2240 from the Numerator 3408, and there remains 1168, which I ſet over the common Denominator thus, $\frac{1168}{1920}$, the Remainder or Difference of $\frac{2}{4}$ and $\frac{4}{6}$ from $\frac{7}{8}$ and $\frac{9}{10}$.

II. To ſubtract a Fraction from a whole Number,

The Rule is,

Subtract the Numerator from the Denominator, and place the Remainder over the Denominator: Then ſubtract one from the whole Number, and place the Remainder before the Fraction before found, which mixt Number is the Remainder or Difference.

Example 1.

Subtract $\frac{8}{12}$ from 18.

Here I ſay, 8 (the Numerator, from 12 (the Denominator, there remains 4, which I place over 12 thus, $\frac{4}{12}$: Then 1 from 18 (the whole Number) reſts 17, which with $\frac{4}{12}$ makes 17 $\frac{4}{12}$ for Anſwer.

Example

Example 2.

From 34 take $\frac{14}{27}$, remains 33 $\frac{13}{27}$.

III. To ſubtract a Fraction from a mixt Number, or one mixt Number from another.

The Rule is,

Firſt, Reduce the Fractions to *Cognomina's*, (or a common Denominator :) Then if the Fraction to be ſubtracted be leſſer than the other, ſubtract the leſſer Numerator from the greater, and place the Remainder over the common Denominator : Alſo ſubtract the leſſer Integral Part from the greater, and the Remainder joyn'd with the remaining Fraction, is the Anſwer requir'd.

Example 3.

From 14 $\frac{4}{5}$ take 12 $\frac{2}{3}$.

The Fractions being reduced are $\frac{10}{15}$ and $\frac{12}{15}$, I ſubtract 10 (the leſſer Numerator) from 12 (the greater) and the Remainder is 2, which I put over 15, the common Denominator, thus, $\frac{2}{15}$: Then 12 (the leſſer Integral Part) from 14 (the greater) reſts 2, which joyn'd with the remaining Fraction $\frac{2}{15}$ makes $\frac{2}{15}$ for the Anſwer.

But if it ſhould happen (as ſometimes it does) that the Fraction to be ſubtracted is greater than the Fraction from whence 'tis to be ſubtracted ; Then

The Rule is,

Subtract the Numerator of the greater Fraction from the common Denominator, and add the Remainder to the Numerator of the leſſer Fraction, and place their Sum as a new Numerator over the common Denominator, which Fraction mind : Then

Then (for one borrow'd) add one to the lesser Integral Part, and subtract it from the greater, and to the Remainder annex the Fraction before-minded; so this new mixt Number shall be the Answer.

Example.

Subtract $15\frac{4}{5}$ from $24\frac{5}{8}$.

Which Fractions reduced, are $\frac{32}{40}$, and $\frac{25}{40}$. Now take 32 out of 25 I cannot, therefore I subtract 32 from 40, (the common Denominator) rests 8, which I add to 25 (the lesser Numerator) and it makes 33 for a new Numerator to 40 (the common Denominator) thus, $\frac{33}{40}$; then 1 borrow'd and 15 (the lesser Integral Part) is 16, out of 24, (the greater, rest 8, to which annex $\frac{33}{40}$, and it makes $8\frac{33}{40}$, the remaining difference requir'd between $15\frac{4}{5}$ and $24\frac{5}{8}$.

CHAP. XVI.

MULTIPLICATION of VULGAR FRACTIONS.

I. IF the Fractions to be multiply'd are both Simple, or both Compound, or one Simple and the other Compound,

The Rule is,

Multiply the Numerators continually for a new Numerator, and multiply the Denominators continually for a new Denominator; which new Fraction is the Product sought.

Three

Three Examples follow to the 3 Cases.

1 Example of both Simple.

What is the Product of $\frac{6}{8}$ by $\frac{5}{7}$?

Numer.		Denom.	
	6		8
Multiply'd	5	Multiply'd	7
	30		56

Answer, $\frac{30}{56}$.

2 Example of both Compound.

Multiply $\frac{4}{5}$ of $\frac{6}{7}$ by $\frac{7}{8}$ of $\frac{11}{12}$.

All the Numerators multiply'd continually.		All the Denominators multiply'd continually.	
	4		5
	6		7
	24		35
	7		8
	168		280
	11		12
	168		3360
	168		
	1848		

Answ. $\frac{1848}{3360}$.

3 Example

3 Example of one Simple and the other Compound.

What is the Product of $\frac{12}{14}$ by $\frac{2}{3}$ of $\frac{6}{8}$ of $\frac{9}{10}$?

All the Numerators Multiply'd.	12 2 — 24 6 — 144 9 — 1296	All the Denominators multiply'd.	14 3 — 42 8 — 336 10 — 3360	Answ. $\frac{1296}{3360}$.

Note, In Multiplication of Fractions, the Product (contrary to Multiplication of whole Numbers) is always less than either of the Terms given: The reason is, because a Fraction being less than one, if I multiply any Fraction by another, it followeth that I take the Fraction less than once, and therefore the Product must needs be less than the first Fraction; yet the third Number or Product beareth the same proportion to each of the two first Fractions that the other of those two Fractions doth bear to a Unit.

II. If a Fraction be to be multiply'd by a whole or mixt Number, or a mixt Number by a mixt Number,

The Rule is,

Reduce the whole, or mixt Number, to an Improper Fraction, (as taught in Reduction, Rule 1.) and then proceed as before.

1 Example

1 Example by a Whole Number.

What is the Product of 32 by $\frac{4}{5}$?

I put a Unit for a Denominator under the Whole Number 32, to make it an Improper Fraction, thus, $\frac{32}{1}$; then $\frac{32}{1}$ by $\frac{4}{5}$ makes $\frac{128}{5}$ for Answer.

2 Example by Mixt Numbers.

What is the Product of $37\frac{4}{6}$ by $15\frac{7}{8}$?

The Mixt Numbers, when reduced to Improper Fractions, are $\frac{226}{6}$ and $\frac{127}{8}$, which multiply'd by Rule 1. of this Chapter, produceth $\frac{28702}{48}$.

In this place of multiplying a mixt Number by a mixt, it may not be unacceptable to the Learner to shew how to solve those pretended nice Questions which many are wont to value themselves for, propounding to, and puzzling others with: It is to multiply Shillings and Pence by Shillings and Pence, and they are commonly proposed after this manner.

Quest. What is the Product of 4 *s.* 6 *d.* by 2 *s.* 6 *d.*

Now many who are unacquainted with Fractions are apt to do it thus.

	s.	*d.*		*s.*	*d.*
	4	6	by	2	6
	12			12	
	54 *d.*			30 *d.*	

	d.		*s.*	*d.*
	54	the Pence in	4	6
Multiply'd by	30	the Pence in	2	6
12)	1620			
2|0)	13|5			
lb. 6	15 *s.*			

And ſo they make 6 *lb.* 15 *s.* for Anſwer, which is juſt 12 times the true Anſwer, as you may ſee by the following true way of working it by Fractions.

Thus,

4 *s.* 6 *d.* by 2 *s.* 6 *d.* that is $4\frac{6}{12}$ by $2\frac{6}{12}$, which being reduced by the Rules already laid down, to an improper Fraction, makes $\frac{1620}{144}$; the value whereof being found, makes 11 *s.* 3 *d.* for the true Anſwer, as you may ſee by the whole Work following.

$4\frac{6}{12}$ by $2\frac{6}{12}$
12   12
————   ————
54   30

54
30
————
New 1620 Numerator.

12
12
————
New 144 Denom.

Makes $\frac{1620}{144}$ which is valued thus.

144) 1620 (11 *s.*
144:
————
180
144
————
36 remains.
12
————
144) 432 (3 *d.*
432
————
(0)

Anſw.

Answ. 11 *s.* 3 *d.* the true Product of 4 *s.* 6 *d.* by 2 *s.* 6 *d.*

Another way of answering Questions of this Nature may be done by cross Multiplication

Thus,

	s.	*d.*
	4	6
Multiply'd by	2	6
	8	0
	1	0
	2	0
	0	3
Makes	11	3 for Answer.

Here the Shillings are multiply'd by the Shillings, gives 8 *s*; then (cross-ways) the 2 *s.* in the Multiplier by the 6 *d.* in the Multiplicand, gives 12 *d.* or 1 *s.* and the 4 *s.* in the Multiplicand being multiply'd by 6 *d.* in the Multiplier, gives 24 *d.* or 2 *s.* Lastly, the Pence of both being multiply'd one into another, makes 36 Parts, (12 of which being counted a Penny) is 3 *d.* The Total whereof is the true Product of 4 *s.* 6 *d.* by 2 *s.* 6 *d.* and so in like manner is any other Number of Shillings and Pence, multiply'd by Shillings and Pence.

CHAP. XVII.

DIVISION of VULGAR FRACTIONS.

I. TO Divide one Single Fraction by another.

The Rule is,

Muitiply the Numerator of the Dividend by the Denominator of the Divisor, and the Product put for a new Numerator of the Quotient; Then multiply the Denominator of the Dividend by the Numerator of the Divisor, and the Product put for the Denominator of the Quotient; and this new Fraction is the Quotient of the said Division.

Example.

What is the Quotient of $\frac{4}{8}$ divided by $\frac{3}{4}$?

Divisor, Dividend.
$\frac{3}{4}$) $\frac{4}{8}$ ($\frac{16}{24}$ Quot.

Here I multiply 4 (the Numerator of the Dividend) by 4, which is the Denominator of the Divisor, and the Product is 16, which I put for a new Numerator of the Quotient; then I multiply 8, (being the Denominator of the Dividend) by 3, the Numerator of the Divisor, and the Product is 24, the Denominator of the Quotient, thus, $\frac{16}{24}$ for Answer, as by the Work in the Margin.

II. If the Dividend, or Divisor, be one or both of them Compound Fractions.

The Rule is,

Reduce the Compound Fractions to Simple ones, and then proceed as before.

Example.

What is the Quotient of $\frac{7}{12}$, divided by $\frac{2}{4}$ of $\frac{3}{5}$?

The Compound Fraction $\frac{2}{4}$ of $\frac{3}{5}$ being reduced to a Simple Fraction, is $\frac{6}{20}$, by which divide $\frac{7}{12}$, the Quotient is $\frac{140}{72}$.

O

Or without Reduction thus.

Multiply the Numerator or Numerators of the Dividend, by the Denominator or Denominators of the Divisor, for a new Numerator; also, multiply the Denominator or Denominators of the Dividend, by the Numerator or Numerators of the Divisor, for a new Denominator: This new Fraction is the Quotient.

Example.

Divide $\frac{3}{4}$ of $\frac{2}{3}$ by $\frac{1}{4}$ of $\frac{1}{8}$.

$$\begin{array}{r} 3 \\ 2 \\ \hline 6 \\ 4 \\ \hline 24 \\ 8 \\ \hline 192 \end{array} \qquad \begin{array}{r} 4 \\ 3 \\ \hline 12 \\ 1 \\ \hline 12 \end{array} \qquad \text{Answer, } \frac{192}{12}.$$

III. If the Dividend and Divisor are both mixt Numbers,

The Rule is,

Reduce the Mixt Numbers to an Improper Fraction, and proceed as before.

Example.

What is the Quotient of $14\frac{4}{5}$ divided by $18\frac{6}{7}$?

The mixt Numbers being reduced to Improper Fractions are $\frac{74}{5}$ and $\frac{132}{7}$; the Quotient of $\frac{74}{5}$ divided by $\frac{132}{7}$, is $\frac{518}{660}$ for Answer.

IV. To divide a whole Number by a Fraction.

The Rule,

Make the whole Number an Improper Fraction, by putting a Unit for a Denominator to it; then multiply the said whole Number by the Denominator of the given Fraction, and place the Product for a new Numerator; and for a Denominator set under it the Numerator of the Fraction. Example, Divide 22 by $\frac{4}{5}$. See the Work in the Margin.

$\frac{4}{5}$) $\frac{22}{1}$ ($\frac{110}{4}$.

V. But to divide the Fraction by the whole Number.

The Rule is,

Multiply the Denominator of the Fraction by the whole Number, and set the Total for the Denominator, not changing the Numerator, as *per* Margin.

$\frac{22}{1}$) $\frac{4}{5}$ ($\frac{4}{11}$.

CHAP. XVIII.

The RULE of THREE DIRECT in VULGAR FRACTIONS.

I. PRepare the Work thus, (1.) Let the first and third Terms be of the same Denomination; if they are not, reduce them to be so. (2.) Let Compound Fractions be reduced to Simple ones. (3.) Let mixt or whole Numbers be reduced to Improper Fractions, the last by putting 1 for the Denominator. Then

II. Multiply the Numerator of the first Term by the Denominator of the second; and that Product by the Denominator of the third Term for a

a new Denominator: Then multiply the Denominator of the first Term by the Numerator of the second, and that Product by the Numerator of the third for a new Numerator. This new Fraction is the fourth Term, or Answer, to the Question.

Example 1.

If $\frac{2}{4}$ of a Yard of Cloth cost $\frac{3}{8}$ of a Pound, what will $\frac{5}{7}$ cost?

First, I place the Three Terms, as taught in whole Numbers, thus.

If $\frac{2}{4}$ cost $\frac{3}{8}$, what cost $\frac{5}{7}$?

Then I proceed to the Work, and multiply 2, the Numerator of the first Term, by 8, the Denominator of the second, and it makes 16, which I multiply by 7, the Denominator of the third Term, and the Product is 112 for a Denominator of the Quotient: Then I multiply 4, the Denominator of the first Term, by 3, the Numerator of the second, and thereof cometh 12, which again I multiply by 5, the Numerator of the third Term, and I have 60 for a Numerator of the Quotient. This Number 60 I place over the Denominator 112, and it makes $\frac{60}{112}$, or in lesser Terms $\frac{15}{28}$, for Answer. See the Work.

Yards.		*lb.*		Yards.
If $\frac{2}{4}$	cost	$\frac{3}{8}$,	what cost	$\frac{5}{7}$?

2	4	
8	3	Answer, $\frac{60}{112}$ *lb.*
16	12	If you would know what that is in Money, work by Rule 5. in Reduction.
7	5	
Denom. 112	Num. 60	

Example 2.

If $\frac{4}{5}$ of an Ell cost $\frac{5}{8}$ of a Pound, what will $\frac{7}{12}$.

4	5	
6	2	
24	10	Answer, $\frac{70}{288}$ *lb.*
12	7	
Denom. 288	Num. 270	

To Resolve the following Questions, observe the Directions laid down at the beginning of this Chapter.

(1) Of Mixt Numbers.

Quest. 1. If 4 $\frac{3}{4}$ Yards of Silk cost 2 $\frac{3}{8}$ *lb.* how much will 14 $\frac{1}{4}$ Yards cost at that rate?

Qu. 2. If 7 Yards of Cloth cost 4 *lb.* $\frac{3}{7}$ what will 18 $\frac{7}{8}$ cost?

(2) Of Whole Numbers.

Qu. 3. If 18 *lb.* of Tobacco cost 2 *lb.* 16 *s.* 6 *d.* what is the Price of 85 $\frac{2}{4}$ *lb.*

Qu. 4. Bought 3 $\frac{2}{4}$ Pieces of Holland, each Piece 22 $\frac{1}{5}$ Ells, at 7 *s.* 6 *d.* $\frac{1}{2}$ *per* Ell, what is the Value of it at that rate?

(3) Of Compound Numbers and several Denominations.

Qu. 5. If $\frac{3}{4}$ of $\frac{5}{6}$ of a *lb.* of Sugar cost 4 *s.* 6 *d.* $\frac{4}{8}$, what cost a hundred Weight?

Qu. 6. If $\frac{2}{4}$ Yards cost $\frac{4}{5}$ of $\frac{7}{8}$ of a *lb.* what is the Amount of 18 $\frac{4}{7}$ Ells *Flemish*?

To prove the Rule of Three Direct in Fractions, the way is the same as in whole Numbers, namely, multiply the first Term by the fourth, and mind the Product; then multiply the second Term by the third, and note that Product also. Now if the two Products are alike, the Work is right, else not.

CHAP.

CHAP. XIX.

The RULE *of* THREE REVERSE *in* FRACTIONS.

QUestions in this Rule are stated as in Whole Numbers, and the Work prepar'd by Rule I of the last Chapter. Then

Multiply the Numerator of the first Term by the Numerator of the second, and the Product by the Denominator of the third Term, for a new Numerator of the Answer: Then multiply the Denominator of the first Term by the Denominator of the second, and that Product by the Numerator of the third Term for a new Denominator. This new Fraction thus found, is the fourth Term, or Answer to the Question.

Example.

If I lend my Friend $\frac{3}{5}$ of Twenty Pounds for $\frac{5}{13}$ of a Year, how long must he lend me $\frac{3}{8}$ of Twenty Pound to return my Kindness.

The three Terms being placed according to Order will stand thus.

If $\frac{3}{5}$ require $\frac{5}{13}$ Years, how long will $\frac{3}{8}$ require?

Then I multiply 3 (the Numerator of the first Term) by 5 (the Numerator of the second, and it produceth 15, which I multiply by 8, the De-nominator of the third Term, and of it comes 120 for a new Numerator of the Answer; also I multiply 5, the Denominator of the first Term, by 13, the Denominator of the second and it makes 65, which I multiply by 3, the Numerator

of the third Term, and the Product is 195 for a new Denominator; so the new Fraction is found to be $\frac{120}{195}$, which is the fourth Term, or Answer to the Question.

Thus,

If $\frac{3}{5}$ —— $\frac{5}{13}$ —— $\frac{3}{8}$

3	5	Answer, $\frac{120}{195}$.
5	13	
15	65	
8	3	
Num. 120	Denom. 195	

Qu. 1. If 10 Men can Mow 18 $\frac{2}{4}$ Acres, in 14 $\frac{3}{4}$ Days, how long will 4 Men be doing the same?

Qu. 2. If $\frac{3}{4}$ of any Drapery that is 2 $\frac{1}{4}$ Yards wide, is sufficient to make a Garment, how much must I have of that sort which is $\frac{4}{5}$ of a Yard wide to make the same Garment?

Qu. 3. If when Wheat is 5 $\frac{2}{4}$ *s. per* Bushel, the Penny White Loaf weighs 8 $\frac{1}{4}$ Ounces, what must it weigh when Wheat is 7 $\frac{6}{12}$ *s. per* Bushel?

The last Question shews the Method of calculating the Assize of Bread, as the Price of Wheat doth rise or fall.

CHAP. XX.

RULES of PRACTICE.

I. THIS Rule teaches how (by the Price of one thing) to find the Price of any Number of things at that rate.

II. All

II. All the poſſible Caſes that can happen in this Rule, may be perform'd by the Golden Rule Direct, by this

General Rule.

As 1 is to the Price of any one thing, ſo is any Number of the ſame things to their Price.

Example.

Cloth at 1 *s.* 6 *d.* $\frac{1}{2}$ a Yard, what comes 132 Yards to? *Anſw.* 10 *lb.* 3 *s.* 6 *d.* See the Operation.

If 1 Yard coſt 1 *s.* 6 *d.* $\frac{1}{2}$, what coſt 132 Yards?

12	74
18 *d.*	528
4	924
74 *q.*	4) 9768 (
	12) 2442 (6 *d.*
	2|0) 20|3 *s.*

Anſwer, *lb.* 10 3 *s.* 6 *d.*

III. But there are briefer Rules to work Practice, which has 4 Caſes.

(1) When the Price of one is 1 *s.* or,
(2) Leſs than 1 *s.* or,
(3) More than 1 *s.* and
(4) When the given Number hath odd Weight or Meaſure annext.

Caſe 1.

IV. When the Price of one is 1 *s.* divide the given Number by 20, that is, cut off 1 from the Right, and take half the reſt for Pounds, the Remainder is Shillings.

Ex-

Example.

At 1 *s.* a Yard, what comes 4321 Yards to?

2|0) 432 (1 — *lb.* *s.*

Answer, 226 1

226

Case 2.

V. If the Price of one be given in Pence, it must be either an Aliquot [or even] or an Aliquant [or uneven] part of a Shilling.

When it is an Aliquot [or even] part of a Shilling, such as 1 *q.* 2 *q.* 3 *q.* 1 *d.* 1 *d.* 2 *q.* 2 *d.* 3 *d.* 4 *d.* and 6 *d.* then proceed by the following Table.

If the Price of one be		Divide the given No. by
1 *q.*		48
2 *q.*		24
3 *q.*		16
1 *d.*		2
1 *d* 2 *q*		8
2 *d.*		
3 *d.*		
4 *d.*		3
6 *d.*		2

The Quotient shall be the Price in Shillings; which bring into Pounds, by cutting off 1 from the Right, and taking half the rest, as before.

Example.

At 4 *d.* a Pound, what comes 325 Pound to?

d. *lb.*

4 3) 325 at 4 *d.*

s. 10|8 4 *d.*

lb. 5 8 *s.* 4 *d.* for Answer.

Note,

Note, If any thing remain, it is always of the ſame Denomination with the given Price of one; ſo here (in dividing by 3) the 1 that remains is 1 Groat, or 4 *d.*

Example 2.

To what comes 474 *lb.* at 3 *d.* *per lb.*

d.	*lb.*	
3	4) 474	at 3 *d.*
	11|8	6 *d.*

lb. 5 18 *s.* 6 *d.* Anſwer.

If the Price of one be an Aliquant [or uneven] Part of a Shilling (ſuch are all Prizes under 1 *s.* that are not mention'd in the foregoing Table) as 5 *d.* 7 *d.* 8 *d.* 9 *d.* 10 *d.* 11 *d.* then you muſt divide the given Number 2, 3, or 4 times.

Thus,

If the Price of one be	take for
5 *d.*	3 *d.* and 2 *d.*
7 *d.*	4 *d.* and 3 *d.*
8 *d.*	4 *d.* and 4 *d.*
9 *d.*	6 *d.* and 3 *d.*
10 *d.*	6 *d.* and 4 *d.*
11 *d.*	4 *d.* 3 *d.* & 4 *d.*

As in the foregoing Table, and divide the given Number by the Numbers againſt them.

The Quotients added ſhall be the Price in Shillings, which bring into Pounds as before (in Rule 4.)

Ex-

Example 1.

At 5 *d.* a Pound, what comes 96 Pound to?

Here for 5 *d.* I take 3 *d.* and 2 *d.* whose Divisors (by the Table) are 4 and 6.

		lb.		*d.*
3 *d.*	4)	96	at	5
2 *d.*	6)	24		
		16		
5 *d.*				

Answ. 40 *s.* or 2 *lb.*

Example 2.

At 7 *d.* a Pound what comes 50 Pound to?

Here for 7 *d.* I take 3 *d.* and 4 *d.* whose Divisors are 4 and 3; and in dividing by 4 there remains 2, which is 2 Threepences, or 6 *d.* and in dividing by 3 there remains 2, which is 2 Fourpences or 8 *d.*

		lb.	*d.*
3 *d.*	4)	50	at 7
4 *d.*	3)	12	6 *d.*
		16	8 *d.*
7			
		29 *s.*	2 *d.*

Example 3.

At 11 *d.* the Yard. what comes 212 Yards to? *Answer*, 194 *s.* (or 9 *lb.* 14 *s.*) 4 *d.* See the Operation.

d.		Yards,		*d.*
4	3)	212	at	11
4				
3	3	70	8 *d.*	
	4	70	8	
11		53	0	
		19|4	4 *d.*	
		lb. 9 14 *s.*	4 *d.*	

Ex-

Example 4.

At 11 *d.* halfpenny a Yard, what comes 276 Yards to?

4 *d.*	3)	276 at 11 ½	
4 *d.*	3	92	
3 *d.*	4	92	
½	24	69	
		11	6 *d.*
11 *d.* 2 *q.*			
		26|4	6
		lb. 13	4 *s.* 6 *d.*

Case 3.

VI. If the given Price of one be more than 1 *s.* that is, any Number of Shillings from 1 to 20, and the Price be given in Shillings only; then multiply the given Number by the Price of one in Shillings; the Product is the Answer in Shillings, which bring into Pounds as before.

Example.

At 7 *s. per* Ell, what comes 1236 Ells to?

Ells.	*s.*
1236 at	7 *s.*
7	
865|2 *s.*	
432 *lb.*	12 *s.*

But if the Price of one be given in Shillings and Pence, or Shillings, Pence and Farthings; work the Shillings by this Rule, and the Pence (or Pence and Farthings) as before (by Rule 5.)

Ex-

Example.

Cloth at 6 *s.* 4 *d.* or at 6 *s.* 4 *d.* 2 *q. per* Yard; what comes 42 Yards to?

d.		Yds.		*s.*	*d.*		*d.*		Yds.		*s.*	*d.*
4	3)	42	at	6	4		4	3)	42	at	6	$4\frac{1}{2}$
		6					$\frac{1}{2}$	24	6			
		252							252			
		14							14			
		26|6							1		9 *d.*	
		13 *lb.* 6 *s.*							26|7		9	
									13 *lb.* 7 *s.* 9 *d.*			

Also, If the Price of one be given in Pounds, Shillings, and Pence; or Pounds, Shillings, Pence and Farthings; first, reduce the Pounds and Shillings into Shillings, and proceed as the last.

Example.

Tobacco, at 3 *lb.* 15 *s.* 4 *d. per* C. what comes 25 C. to?

d.		C.		*lb.*	*s.*	*d.*
4	3)	25	at	3	15	4
		75		20		
		125		75 *s.*		
		175				
		1875				
		8		4 *d.*		
		188|3		4		
		lb. 94		03 *s.*	4 *d.*	

In

In some particular Prices the Work may be abridg'd by the Aliquot Parts of a Pound.

Thus,

If the Price of one be	*s.*	*d.*		Divide the given No. by
	1	3		16
	1	4		15
	1	8		12
	2	0		10
	2	6		8
	3	4		6
	4	0		5
	5	0		4
	6	8		3
	10	0		2

The Quotient shall be the Price in Pounds, and what remains is of the same Denomination with the given Price of one; so if the Price of one be 3 *s.* 4 *d.* and there remains 2 after Division, that 2 is 2 times 3 *s.* 4 *d.* or 6 *s.* 8 *d.*

Example.

At 3 *s.* 4 *d. per* Yard, what comes 1233 Yards to?

Yards, *s.* *d.*
6) 1233 (at 3 4

lb. 205 10 *s.*

Case 4.

VII. When the given Number hath odd Weight or Measure annext to it, work the whole Number as before; then divide the given Price by such Parts as the odd Weight or Measure is of one of the whole Number (or by the Parts of one another) the Sum of which added to the first Work gives the Answer.

Ex-

Example 1.

What is the Amount of 527 *C.* 1 *qu.* at 12 *s.* 6 *d. per C.*

d.		*C.*	*qu.*		*s.*	*d.*
6	2)	527	1	at	12	6
		12				

	d.	*q.*
6324		
263	6	
3	1	2
659|0	7	2

q.		*s.*	*d.*
1	4)	12	6
		3	1 2

lb. 329 10 *s.* 7 *d.* 2 *q.* Answer.

Here I proceed with the whole Number as usual, and for the 1 qu. I divide the given Price (12 *s.* 6 *d.*) by such a Part as 1 qu. is of a C. namely 4, and of it comes 3 *s.* 1 *d.* $\frac{1}{2}$, which I add to the other Work, as you see above.

Another Example of the same follows.

d.		*C.*	*qu.*	*lb.*		*s.*	*d.*	
6	2)	521	3	16	at	23	10	*per C.*
4	3	23						
10								

	d.
1563	
1042	
260	6
173	8
21	3 $\frac{1}{4}$
1243|8	5 $\frac{1}{4}$
621 18	5 $\frac{1}{4}$

q.			*s.*	*d.*
2		2)	23	10
1				
lb.	2		11	11
14	2		5	11 $\frac{1}{2}$
2	7		2	11 $\frac{3}{4}$
			0	05
3 *q.* 14 *lb.*			21	03 $\frac{1}{4}$

For

For the odd Weight in this Example, I divide the Parts one out of another, and add the Total as before.

CHAP. XXI.

Short Ways to cast up Merchandize, fit for Retailers of small Parcels, as Mercers, Linnen and Woollen Drapers, Haberdashers of Hats, &c.

I. WHen the Number of things exceeds not 10, the readiest way is to multiply the Price of 1 by the Number of things.

Example.

Sold 7 Yards at 14 *s.* 6 *d.* a Yard.

			7
Facit lb.	5	01	6

Say, 7 times 6 *d.* is 42 *d.* that is, 3 *s.* 6 *d.* set down 6 *d.* and carry 3 *s.* to the place of Shillings, and say, 7 times 4 *s.* is 28 *s.* and 3 that I carry is 31 *s.* set down 1 *s.* and carry 3 Angels (or 3 Ten Shillings) to the place of Tens of Shillings, and say, 7 times 1 is 7, and 3 I carry, is 10 Angels, which is 5 *lb.* set 0 in the place of Tens of Shillings, and 5 in the place of Pounds; so the Price of 7 Yards is 5 *lb.* 1 *s.* 6 *d.*

II. For any Number of Things, betwixt 10 and 100, find 2 Numbers in your Multiplication Table that being multiply'd together, will make the

the given Number; then multiply the Price of the thing by one of those Numbers, and that Product by the other Number.

Example.

Sold 14 Yards at	1 *lb.*	07 *s.*	10 *d.*
		7	
	9	14	10
			2
Facit	19	09	08

Here I multiply by 7 and by 2, because 2 times 7 is 14.

III. When you cannot find the given Number in your Table of Multiplication, then multiply by 2 such Numbers, as being multiply'd together, will come nearest to it, and multiply the given Price of one by the Part that is wanting. As in this Example.

Sold 30 Ells at 7 *s.* 09 *d.*

7 *s.*	09 *d.*				
	2				7
15	06		2	14	03
					4
			10	17	00
				15	06
		Facit	11	12	06

Here I multiply by 7 and 4, because 7 times 4 is 28; and for the 2 Ells that are wanting, I multiply the Price by 2, and add the Product to the former.

IV. For

IV. For Goods Sold by the Hundred Weight, or 112 *lb.* Multiply the Price in Pence that 1 *lb.* costs, by 7, and divide the Product by 15, the Quotient is the Price (in Pounds) of a Hundred Weight.

Example.

At 5 *d.* a Pound, what costs 112 *lb.*?

```
     7
   ———— l.  s.  d.
15) 35 ( 2  6   8 the Answer.
    30
   ————
     5
    20
   ————
15) 100 (6 s.
     90
   ————
     10
     12
   ————
     20
     10
   ————
15) 120 (8 d.
    120
   ————
    000
```

Say, 15 in 35 2 times rests 5, which is 100 *s.* then 15 in 100 6 times, and 10 remains, which is 120 *d.* Then 15 in 120 is 8 times. *Facit* 2 *lb.* 6 *s.* 8 *d.*

Otherwise, By the 1st, 2d, or 3d Rule, multiply 2 *s.* 4 *d.* by the Number of Farthings in the Price of a Pound, the Product is the Price of the Hundred Weight.

Example.

Example.

At 3 *d.* 2 *q.* a Pound, what comes 112 *lb.* to?

4		*s.*	*d.*
14 *q.*		2	04
			7
		16	04
			2
Facit	1 *lb.*	12 *s.*	08 *d.*

V. For Goods sold by Tale, at 5 Score to the Hundred: Multiply the Price of one (in Pence) by 5, and divide the Product by 12; the Quotient is the Price (in Pounds) of a Hundred.

Example.

At 3 *d.* a-piece Lemmons, what is that a Hundred?

3 *d.*
5
l. *s.*
12) 15 (1 5
12
3
20
12) 60 (5 *s.*

Otherwise, Multiply 2 *s.* 1 *d.* by the Number of Farthings in the Price of one; the Product is the Price of a Hundred. Thus in the foregoing Example repeated.

3 *d.*

3 *d.*		*s.*	*d.*
4		2	1
12 *q.*			4
		8	4
			3
	Facit 1	5	0

VI. For things sold by Tale, at 6 Score to the Hundred, as Deals, *&c.* Take half the Price of one (in Pence) and you have the Price of a Hundred in Pounds. Example, At 13 *d.* the Deal-Board, what costs a Hundred? Answ. 6 *l.* and a half, or 6 *l.* 10 *s.* If there be odd Farthings in the Price of one, for every odd Farthing add 2 *s.* 6 *d.* Example, At 13 *d.* 2 *q.* the Deal-Board, what costs a Hundred? Answ. 6 *lb.* 15 *s.*

VII. For Wine or Oyl sold by the Tun of 252 Gallons. From so many Pounds as the Tun doth cost, abate so many Shillings, and the Gallon will be worth so many Pence as there remain Pounds.

Example 1. If a Ton costs 25 *l.* what costs a Gallon? *Answ.* 23 *d.* (or 1 *s.* 11 *d.* 3 *q.*) See the Operation

	l.	*s.*		*s.*	*d.*	*q.*
From	25	00				
Subtract 25 *s.* or	1	5				
	23	15	*Facit*	1	11	3

Here every Pound of the Remainder is valu'd at 1 *d.* and every 5 *s.* at 1 *q.*

Example 2. At 21 *lb.* 5 *s.* a Ton, what costs a Gallon? *Answ.* 20 *d.* or 1 *s.* 8 *d.*

From

From	21 *lb.*	5 *s.*	subtract 25 *s.*
or	1	5	
There remains	20	0	*Facit* 1 *s.* 8 *d.*

VIII. Contrary to Rule 4. If the Price of 100 Weight (or 112 *lb.*) be given to find the Price of a Pound, multiply the Shillings of the Price of 1 C. by 3, adding the odd Groats of the Price, (if there be any) and divide the Product by 7, the Quotient is Farthings for the Price of a Pound.

Example, Cheese at 23 *s.* 4 *d.* *per* C. what costs a Pound? *Answ.* 10 *q.* or 2 *d.* 2 *q.* for 23 multiply'd by 3, is 69, and one added is 70, which divided by 7, gives 10 *q.* the Answer.

IX. Contrary to Rule 5. The Price of 100 things being given, to find the Price of one: Multiply the Shillings of the Price of 100, by 3, adding the odd Pence of the Price, (if there be any,) and divide the Product by 7; the Quotient is Farthings for the Price of one.

Example. If 100 of Lemmons cost 18 *s.* 9 *d.* what is that a-piece. *Answ.* 9 *q.* or 2 *d.* 1 *q.* See the Operation.

s.	*d.*
18	9
3	

7) 63 (9 *q.* the Answer.
63

0

X. Contrary to Rule 6. The Price of 120 things being given, to find the Price of one. Double the Price of 120 in Pounds, and you have the Price of one in Pence.

Ex-

Example.

At 6 *l.* the Hundred Deal Boards, what cost one? *Answ.* 12 *d.*

If there be odd Shillings in the Price of the Hundred; for every half Crown of those odd Shillings add 1 *q.* to the Price of one.

Example.

At 6 *l.* 5 *s.* the Hundred Deal Boards, what cost one? *Answ.* 12 *d.* 2 *q.*

Some short Forms of Bills (to Exercise the Rules of Practice) applicable to Business.

A Mercer's Bill.

Bought of *John Smart*, *March* 6. 1710

	s.	d.	l.	s.	d.
8 Yards of Flower'd Damask, at *per* Yard.	5	6			
6 Yards of Lustring, at	4	2			
12 Yards ¼ of Flower'd Sattin at	12	8			
4 Yards of Spring Tabby, at	5	4			

A Goldsmith's Bill.

Bought of *Tho. Glitter*, *March* 27, 1710.

	oz.	dw.	s.	d.	l.	s.	d.
A Mazarene Dish weight	37	10, at	6	2			
per oz							
A Large Tankard, weight	42	15, at	5	6			
18 Silver Spoons, weight	36	12, at	6	4			
A Salver Japand, weight	22	5, at	6	8			

A Linnen-Draper's Bill.

Bought of *James Measurewell*, *March* 29, 1710,

	s.	d.		l.	s.	d.
24 Ells of Muslin, at	6	6	*per* Ell.			
18 Ells of Holland, at	7	2				
16 $\frac{1}{3}$ Ells of Diaper, at	3	4				
12 Ells of Dowlas, at	2	1				

A Woollen-Draper's Bill.

Bought of *Abraham Fairspoken*, *April* 2d. 1710.

	s.	d.	l.	s.	d.
6 Yards of fine mixt, at *per* Yard.	18	6			
8 $\frac{1}{4}$ Yards of fine Black, at	17	4			
12 Yards of *Drap de Bury*, at	12	8			
15 $\frac{1}{2}$ Yards of Frieze, at	4	2			

A Grocer's Bill.

Bought of *William Sanders*, *April* 7, 1710.

C.	l.	s.	d.		l.	s.	d.
27 $\frac{1}{4}$ of Sugar, at	2	10	6	*per* C.			
15 $\frac{1}{2}$ of Raisins, at	5	19	4				
2 $\frac{1}{4}$ of Currants, at	2	05	8				
7 $\frac{3}{4}$ of Tobacco, at	4	10	6				

A Milliner's Bill.

Bought of *Mary Talkmuch*, *April* 12, 1710.

	s.	d.	l.	s.	d.
4 Suits of Knots, at *per* Suit.	12	6			
8 Pair of Gloves, at	2	4			
4 Sarsnet Hoods, at	6	8			
12 $\frac{1}{4}$ Yards of Flower'd Ribbon, at	2	7			

A Hosier's Bill.

Bought of *Timothy Stocking*, *April* 15, 1710.

	s.	d.	l.	s.	d.
10 Pair of Thread Hose, at *per* Pair.	3	4			
8 Pair of Womens Silk Hose, at	8	6			
9 Pair of Mens, *Ditto*, at	12	4			
6 Pair of Scarlet, *Ditto*, at	10	6			

A Wine-Cooper's Bill.

Bought of *Aaron Grape*, *May* 6, 1710.

	s.	d.	l.	s.	d.
24 Gallons of White-Wine, at *per* Gallon.	4	8			
36 Gallons of Claret, at	5	2			
16 Gallons of Canary, at	8	6			
20 Gallons of Sherry, at	7	4			

Thus might I give Examples of all other Trades in general, but these being sufficient, I omit them for Brevity sake.

CHAP. XXI.

Of TARE, TRET, and CLOFF.

BEfore I lay down the *Rules*, it will be proper to explain the *Terms* that are commonly used in these Affairs, and they are these;

I. *Gross-weight*, is the Weight of both Goods and Cask, (or Bag, or whatever else the Goods are put up in,) as they are weigh'd all together.

II. *Neat-weight*, is the Weight of the Goods alone.

III. *Clear-weight*, is the Weight remaining, when all the Allowances of Tare, Tret, &c. that are to be allow'd, are deducted.

IV. The *Hundred-Gross*, call'd also the *Great Hundred*, and a *Hundred-weight*, is 112 Pounds.

V. The *Hundred-Suttle*, is 100 Pound. This is also call'd the *Small-Hundred*, and by some (tho' improperly) the *Neat-Hundred*.

VI. *Tare*, is the Weight of the Cask, or Bag, or whatever else the Goods are put up in.

VII. *Invoice-Tare*. Sometimes the Tare is marked upon the Cask, (or Bag, &c) and then it is called *Invoice-Tare*, signifying that the Tare has been consider'd before the Goods were put up, either by weighing the Cask, (or Bag, &c.) or else by Estimation; for there are divers things (especially Tobacco) whose Tare is held at a certain Estimate, according to the Hundred-Weight, Gross-Weight.

VIII. *Tret*, is an Allowance of 4 *lb.* to the Hundred-Suttle, that is, 104 *lb.* for 100. This Allowance is given (by Custom) to Freemen of *London*,

London, (unleſs the Bargain be made to the con-trary, and no Tret to be allow'd, by reaſon of the Cheapneſs of the Price) upon all Garbled Goods, (ſuch as Indico, Pepper, Cloves, Nutmegs, and many other Grocery Druggs,) in conſideration of the Duſt, Droſs, or other impure Subſtance with which any Commodity is mixt.

IX. *Cloff*, (commonly call'd *Cluff*,) is an Allowance of 2 *lb* to every Draught exceeding 336 *lb.* or 3 Hundred Weight Groſs.

Having thus explain'd the Terms, I ſhall now lay down the Rules.

X. To find the Neat-weight of any Goods: The Rule is,

Subtract the Tare from the Groſs-weight, and the Remainder is the Neat-weight.

Example 1.

	C.	*qrs.*	*lb.*	
Sold,	14	2	10	Groſs.
Tare,	1	3	17	
Reſts	12	2	21	Neat-weight.

Examp. 2. Sold 6 Hogſheads of Sugar, *viz.*

Groſs,	C.	*qr.*	*lb.*	Tare.	C.	*qr.*	*lb.*
Ћ. No. 1	14	3	15		1	3	20
2	17	1	19		2	0	05
3	16	2	14		2	1	10
4	17	1	10		2	1	16
5	18	2	17		2	2	06
6	14	1	22		1	3	22
Sum of Groſs,	99	1	13	Tare,	13	0	23
Tare,	13	0	23	ſubtracted.			
Reſts	86	0	18	Neat-weight.			

But

But if the Tare be rated at ſo much *per* C wt. then find the Total of the Tare, by Rule 12 following, which ſubtract from the Groſs-weight as before, and you have the Neat-weight.

XI. To reduce any given Weight Groſs into Pounds Suttle. The Rule is,

Multiply the Hundreds by 4, adding in the odd Quarters, (if any be) then multiply the Product by 28, adding in the odd Pounds, (if there be any) as was taught in Chap. 7 of Reduction.

Example.

In 24 *C.* 3 *qrs.* 17 *lb.* how many *lb.* Suttle?

```
 4
———
 99
 28
———
799
199
———
```

Facit 2789 *lb.* Suttle.

XII. To find the Total Sum of the Tare, when 'tis rated at ſo much *per* Hundred-weight. The Rule is,

By the foregoing Rule, bring the Groſs-weight into Pounds Suttle, which multiply by the Tare of a Hundred-weight, and divide the Product by 112; the Quotient is the whole Sum of the Tare belonging to the Groſs-weight given.

Example.

In 24 C. 3 *qr.* 17 *lb.* how many *lb.* Tare, at 14 *lb.* Tare *per* Hundred-weight? *Anſw.* 348 *lb.* See the Work.

C.	qr.	lb.
24	3	17
4		
99		
28		
799		
199		

2789 *lb.* Suttle.
14 *lb.* Tare *per* C.

11156
2789

112) 39046 (348 *lb.* Tare, sought.
336
544
448
966
896
70

XIII. To find the *Tret* to be allow'd in any Weight Groſs. The Rule.

Reduce the Groſs-weight of the Neat-weight of the Goods into Pounds Suttle, (by Rule 11.) then divide the Pounds Suttle by 26, and the Quotient ſhall be the Tret ſought.

XIV. To find the *Cloff* to be allow'd in any given Weight-Groſs. The Rule.

This is eaſily found, by allowing 2 *lb.* for every Draught that exceeds 3 Hundred Weight.

XV. To find the Clear-weight of any Goods, abating the Tare, Tret, and Cloff, The Rule is,

First, find the Neat-weight (by Rule 10.) Then reduce the Neat weight into Pounds Suttle, (by Rule 11.) Then find the Tret, and Cloff, (by the 13th and 14th Rule,) and subtract it from the Pounds Suttle, and the Remainder is the Clear-weight of the Goods, or so-much as the Buyer is to pay for.

XVI. Having found the Clear-weight of any Goods, in Pounds Suttle, it is necessary to bring them back again into Gross-weight, because the Buyer commonly pays for them by the C. weight, at so-much *per* C. *&c.* Now to reduce Pounds Suttle into Gross-weight, This is the Rule.

Divide the Pounds Suttle by 28, the Quotient shall be quarters of a Hundred, and the Remainder (if any be) shall be the odd Pounds. Then divide the last Quotient by 4, and the Quotient shall be Hundreds; and the Remainder (if any be) shall be the odd quarters of a Hundred, as was taught in Chap. 7. of Reduction. An Example or two will make all plain.

Example 1.

A Merchant has sold 5 Hogsheads of Raisins, allowing the Buyer Tare, Tret, and Cloff. The particular Weights of the Hogsheads are as follow. I demand the Clear-weight (of all the Goods) that the Buyer is to pay for? *A.* 2239 *lb.* Suttle, or 19 C. 3 *qr.* 27 *lb.* Gross-weight. See the Operation.

Gross,

	Groſs,	C.	qr.	lb.	Tare,	C.	qr.	lb.
4.	No. 1	1	3.	26.		0	0	21.
	2	2	2.	18.		0	1.	10
	3	4	1	12		0	2	16.
	4	6	2	09.		0	3.	12
	5	8	1.	19		1	0	15
	Sut. Groſs	24	0	00	Sut. Tare	3	0	18
	Sut. Tare	3	0	18	ſubtracted.			
	Reſts	20	3	10	Neat-wt. of the Goods,			

4 mult. by 4, and the 3 *qrs.* added.

Makes 83 *qrs.* of C. which multiply'd
by 28 and the 10 *lb.* added.

664
167

Makes 2334 *lbs.* Suttle. Then,

lb.
26) 2334 (89 Tret. (weight.
208 6 Cloff, for the 3 Draughts above 3 C.

254 95 Sum of Tret and Cloff.
234

20

Then, from the Neat-wt. in *lbs.* Suttle, *lb.* 2334
ſubtract the Sum of the Tret and Cloff, 95
and there remains the Clear-weight in *lb.* Sut. 2239
which you may reduce back again into the C.
Groſs, by Diviſion, thus.

```
      4        C.     qr.    lb.
28) 2239 (79 (19      3      27
    196   4
    ---------
     279  39
     252  36
    ---------
    27 lb. 3 qrs.
```

The Clear-weight that the Buyer is to pay for.

Example 2.

Sold 4 Hogsheads of Tobacco, Gross-weight, of each 4 *C.* 3 *qrs.* 17 *lb.* Tare, 14 *lb. per C.*

```
           4
   ----------
   19  2  12
    4
   ----
   78 qrs.
   28
   ----
   726
   157
   ----
   2296 lb. Suttle.
     14
   ----
   9184
   2296
   ----
112) 32144 (287 lb. the Tare sought.
     224::
     ----
      974:
      896:
     ----
       784
        84
     ----
       000
```

Then from the whole Gross-Weight, 2296 *lb.*
Subtract the Tare 287
Rests the Neat-weight 2009
which reduced into the Hundred-Gross (by Rule 16.) is 17 *C.* 1 *qr.* 26 *lb.*

CHAP.

CHAP. XXII.

Of BARTER.

I. BArter is the exchanging of Ware for Ware. or one Commodity for another.

II. This Rule shews the Merchants how they may so proportion the Prizes of their Goods, as that neither may sustain Loss.

III, It will not be difficult for him that is perfect in the Rule of 3, to solve any Question in this Rule, they being all perform'd by that Rule, There are several Cases in this Rule.

Case 1.

IV. So much Goods at such a Price, barter'd for other Goods at such a Price; To find how much of the *latter* must be deliver'd for the former.

Rule.

First find what the *former* Goods are worth, by saying, As 1 is to the Price of 1 *lb.* (&c so is the whole Number of *lbs.* (or the like) to the whole Price of the former Goods.

Then say, As the Price of 1 *lb.* (&c.) of the *latter* is to 1, so is the whole Price of the *former* to the Number of *lbs.* (&c.) of the *latter* that must be deliver'd for the former Goods.

Example.

Two Merchants Barter; *A* has 3 *C.* of Pepper at 1 *s. per lb*; *B* has Ginger at 2 *s. per lb.* How much Ginger must be deliver'd for the Pepper? *Answer*, 168 *lb.*

For

For if 1 *lb.* of Pepper cost 1 *s.* what will 3 C Weight, or 336 *lb.* cost? *Answ.* 336 *s.*

Then, If 2 *s.* buy 1 *lb.* of Ginger, what will 336 *s.* buy. 168 *lb.* which is the Answer to the Question.

Case 2.

V. When one Man has Goods at such a Price the *lb.* (*&c.*) ready Money, but in Barter he will have such a Price: The other has Goods at such a Price the *lb.* (*&c.*) ready Money: To find how he must rate his Goods in Barter so as to be no Loser.

Example.

Two Men exchange Merchandize, the one hath Tobacco at 2 *s.* 6 *d. per lb.* ready Money, but in Barter he will have 3 *s.* 6 *d. per lb.* The other hath Cloth at 4 *s.* the Ell ready Money: Now the Question is, how he ought to rate the Ell in Barter to be no Loser.

Rule.

As the Price of the first in ready Money is to its Price in Barter, so is the Price of the second in ready Money to its Price in Barter; that is by the Rule of Three

Thus,

If 2 *s.* 6 *d.* ready Money gives 3 *s.* 6 *d.* in Barter, what shall 4 *s.* give in Barter? Multiply and divide, and you will find 5 *s.* 7 *d.* $\frac{1}{5}$: And at that Price ought the second Man to sell his Cloth in Barter to save himself harmless.

Case 3.

VI. When one Man has Goods at such a Price the *lb.* (*&c*) ready Money, but in Barter will have such a Price the *lb.* *&c.* The other has Goods,

Goods, which he deliver'd in Barter at ſuch a Price the *lb.* *&c.* To find how he ſold his Goods *per lb.* *&c.* in ready Money.

Rule.

As the Price of the firſt in Barter is to its Price in ready Money, ſo is the Price of the ſecond in Barter to its Price in ready Money.

Example.

Thomas and *James* Barter, *Thomas* hath Nutmegs worth 1 *s.* 6 *d.* the *lb* ready Money, but in Barter will have 2 *s.* the *lb.* and *James* hath Tea which he delivered in Barter at 18 *s.* the *lb.* The Queſtion is, what his Tea coſt him *per lb.* in ready Money?

Say by the Golden Rule, If 2 *s.* in Barter give 1 *s.* 6 *d.* ready Money, what does 18 *s.* in Barter require ready Money. Work and you have 13 *s.* 6 *d.* for Anſwer.

Caſe 4.

VII. When one Man has Goods at ſuch a Price the *lb.* *&c.* to be ſold for ready Money, but in Barter will have ſuch a Price; and yet will have a certain Part of his Barter Price (as ſuppoſe $\frac{1}{2}$, $\frac{2}{3}$, or the like) in ready Money: The other has Goods at ſuch a Price the *lb.* *&c.* in ready Money: To find how he muſt deliver it by the *lb.* *&c.* to ſave himſelf harmleſs, and make the Barter equal.

Rule.

Take that part of the Barter-price, and ſubtract it from the ready Money Price, and alſo from the Barter-price, and note the Remainders. Then ſay, as the firſt Remainder is to the ſecond, ſo is the ſecond Man's ready Money Price to the Price

he

he must sell it at in Barter, to make the Barter equal.

Example:

Two Men Barter, the one hath Wine at 16 *l.* the Hogshead, ready Money, but in Barter he will have 20 *l.* and yet he will have $\frac{1}{4}$ part of his Barter-price in ready Money; and the other hath Stockings at 3 *s.* 6 *d.* the Pair ready Money: The Question is, how he ought to deliver the Stockings *per* Pair in Barter, to save himself harmless, and make the Barter equal.

Here (by the Rule) I first take $\frac{1}{4}$ Part of 20 (the Barter-price) which is 5, and subtract it from 16 (the ready Money price) rests 11; and also from 20 (the Barter-price) and there remains 15, which two Remainders 11 and 15 I take for the two first Terms in the Golden Rule, and 3 *s.* 6 *d.* (the Price of the Stockings) for the third Term, and say,

If 11 *l.* give 15 *l.* what shall 3 *s.* 6 *d.* give?

Multiply and divide, and you shall find 4 *s.* 9 *d.* $\frac{720}{2640}$; and for so much must the second Man sell his Stockings a Pair in Barter to be no Loser.

Case 5.

VIII. When one Man has Goods at such a Price the *lb.* &c. in ready Money, but in Barter he rates them at such a Price, as that he will gain so much in the 100 *l.* The other has Goods at such a Price the *lb.* &c in ready Money: To find how he shall rate his Goods the *lb.* &c. in Barter.

Example.

A and *B* Barter, *A* hath Brandy at 22 *l.* *per* Hhd. ready Money, but in Barter he will have after the rate of 10 *l.* in 100 *l.* Advance: And

B hath Broad Cloth at 15 *l.* the Piece, ready Money; The Question is, how *B* ought to rate his Cloth the Piece, to make a proportionable Advance in Barter.

First find *A*'s Barter-price at 10 *l.* in 100 *l.* Advance, thus,

If 100 *l.* give 110 *l.* what will 22 *l.* give? Work, and you will have 24 *l.* 10 *s.* Then,

As *A*'s ready Money price is to his Barter-price, so is *B*'s ready Money Price to his Barter-price, thus.

If 22 *l.* give 24 *l.* 10 *s.* what shall 15 *l.* give?

Multiply and divide, and it produceth 16 *l.* 10 *s.* a proportionable Advance for Answer.

Two Men (*A* and *B*) Barter, *A* hath 74 *C.* Weight of Sugar, at 2 *l.* 17 *s.* 10 *d.* *per C.* for which *B* giveth him 128 Yards of Silk, and 100 *l.* in Money; *Query*, how much *B* valued his Silk *per* Yard.

Two Men exchange Commodities, the one hath 24 Barrels of Indico, each 2 C. $\frac{3}{4}$ 17 *lb.* at 3 *l.* 10 *s.* 4 *d.* *per* C. for which the other giveth him 50 *l.* in Money, the rest in Dowlas, at 3 *s.* 4 *d.* *per* Yard: The Question is, how many Yards of Dowlas he must give more than the 50 *l.* to make the Exchange equal.

CHAP. XXIII.

Of EXCHANGE.

I. THIS Rule teaches Merchants how to Exchange the Moneys (Weights or Measures) of one Country, into (or for) the Moneys (Weights

(Weights or Measures) of another Country: As if a Merchant pay so much Money in one City, in one sort of Money, to receive the Value thereof in another City, in another sort of Coin; and all Questions in this Rule are solved by the Golden Rule, or Practice.

II. In the Exchange of Coins, it is necessary that the *Par*, or Value of the Money in each place be exactly known.

Note then, that the Word *Par* signifies to equalize the Money of Exchange from one place with that of another: As when I take up so much Money by Exchange in one place, to pay the just Value of it in another kind of Money in another place.

Having noticed this, I proceed,

I. *In the* Netherlands.

Here *London* Exchanges with
Antwerp, seated upon the *Scheld* in *Brabant*.
Amsterdam, *Rotterdam*, } in *Holland*.
Brussels, *Lisle*, } in *Flanders*.
Dort, *Middleburgh*, } in *Zealand*.

In these Places Accompts are kept in Pounds, Shillings, and Pence, *Flemish*, or (as the Merchant fancys) in Guilders and Livers.

The *Par* is 33 *s.* 4 *d.* for the Pound Sterling, [or *English* Money] or at 2 *s.* Sterling for the Guilder.

1. *Of Sterling into* Flemish.

Example.

A Merchant deliver'd in *London* 390 *l.* to receive the same again at *Antwerp* in Pounds *Flemish*,

miſh, I demand how many Pounds he muſt receive? *Anſwer*, 234 *l.* See the Operation by the Golden Rule thus,

If 33 *s.* 4 *d* give 1 *l. Fl.* what ſhall 390 *l.* give?

```
 12                              20
----                           ------
 400                            7800
                                  12
                               ------
                      4|00)    936|00
                               ------
                      Facit    234 l. Flemiſh.
```

2. *Of Flemiſh* Pounds into Sterling.

Example 2.

Change me 234 *l. Flemiſh* into Pounds Sterling, *Par* as before, by Practice thus.

```
d.      l. Fl.     s. d.
4   3)  234   at  33 4
         33
       -----
         702
        702
       -----
        7722
          78
       -----
        780|0
       -----
        390
```

Anſwer, 390 *l.* Sterling, or Proof of the laſt.

Example 3.

How many Guilders muſt be paid in *Liſle*, the *Par* at 2 *s.* Sterling *per* Guilder, in Exchange for 249 *l.* 10 *s.* receiv'd in *London*.

s. Guilder, *l.* *s.*
If 2 give 1 what shall 249 10 give?
20

2) 4990

Answ. 2495 Guilders.

Example 4.

Change me 2495 Guilders back again into *lbs.* Sterling.

s. Guilders, *s.*
2 1|0) 249|5 at 2

Facit 249 *l.* 10 *s.* for Answer.

II. *In* France:

London Exchanges with

Paris,	the Capital City of	*France.*
Lyons,		*Lyonnois.*
Roan,		*Normandy.*
Marseilles,		*Provence.*
Bisanzon.		*Burgundy.*
Bourdeaux,		*Guienne.*

They keep their Accompts in Livers, Sols and Deniers, of which

12 Deniers is 1 Sol.
20 Sols 1 Liver.
3 Livers 1 Crown.
60 Sols 1 Crown.

But generally exchange in Crowns.

The *Par* is 4 *s.* 6 *d.* Sterling for the *French* Crown, or 1 *s.* 6 *d.* Sterling for the Liver.

1. Of *Sterling into* French *Crowns.*

Exampl

Example 1.

A Merchant in *London* remits a Bill of Exchange to *Paris*, for 370 *l.* 2 *s.* 6 *d.* Sterling; the *Par* 4 *s.* 6 *d.* *per French* Crown: I demand how many *French* Crowns must be paid at *Paris* for the said Bill?

```
  s. d. French Crown,          l.  s. d.
If 4 6 give 1 what shall  370  2 6 give?
   12                      20
  ----                   -----
  54 d.                  7402 Shillings.
                           12
                        -----
                   54) 88830 (1645 Crowns.
                       54:::
                       -----
                       348::
Answ. 1645 Fr. Crowns, 324::
                       -----
                        243:
                        216:
                       -----
                         270
                         270
                       -----
                         000
```

Example

	s.	Guilder,		*l.*	*s.*	
If	2 give	1	what shall	249	10	give ?
				20		

2) 4990

Answ. 2495 Guilders.

Example 4.

Change me 2495 Guilders back again into *lbs.* Sterling.

s.	Guilders,	*s.*
2	1|0) 249|5 at	2

Facit 249 *l.* 10 *s.* for Answer.

II. *In* France.

London Exchanges with

Paris,	the Capital City of	*France.*
Lyons,		*Lyonnois.*
Roan,		*Normandy.*
Marseilles,		*Provence.*
Bisanzon.		*Burgundy.*
Bourdeaux,		*Guienne.*

They keep their Accompts in Livers, Sols and Deniers, of which

12 Deniers is	1 Sol.
20 Sols	1 Liver.
3 Livers	1 Crown.
60 Sols	1 Crown.

But generally exchange in Crowns.

The *Par* is 4 *s.* 6 *d.* Sterling for the *French* Crown, or 1 *s.* 6 *d.* Sterling for the Liver.

1. Of *Sterling into* French *Crowns.*

Exampl

Example 1.

A Merchant in *London* remits a Bill of Exchange to *Paris*, for 370 *l.* 2 *s.* 6 *d.* Sterling; the *Par* 4 *s.* 6 *d.* *per French* Crown: I demand how many *French* Crowns must be paid at *Paris* for the said Bill?

```
  s. d. French Crown,        l.  s. d.
If 4 6 give 1 what shall 370  2 6 give?
  12                         20
 ----                       ----
  54 d.                     7402 Shillings.
                              12
                            ----
                       54) 88830 (1645 Crowns.
                           54:::
                           -----
                           348::
Answ. 1645 Fr. Crowns,     324::
                           -----
                            243:
                            216:
                            ----
                             270
                             270
                             ---
                             000
```

Example 2.

Change me 1645 *French* Crowns into Pounds Sterling, *Par* as before.

d.	Fr. Crowns,	s.	d.
6	2) 1645 at	4	6
	4		
	6580		
	822	6 *d.*	
	740|2	6	

Facit 370 *l.* 2 *s.* 6 *d.* or Proof of the last.

I might here go on to instance Examples of the like in *Italy*, *Spain*, *Portugal*, *Germany*, &c. But because they are done after the same manner with those already laid down above: I shall only mention the *Pars*, and omit the Work.

In Italy.

The *Par* at *Venice* with our Sterling Money, is at 4 *s.* 3 *d.* (sometimes 4 *s.* 4 *d.*) Sterling for the Duccat.

In Spain.

The *Par* at *Leghorn*, *Genoa*, *Cales*, *Madrid*, and other parts of *Spain*, is at 4 *s.* 4 *d.* Sterling for the Dollar, or Piece of Eight.

In Portugal.

The *Par* at *Lisbon*, and *Oporto*, is at 6 *s.* 8 *d.* $\frac{1}{2}$ Sterling, for the *Mil-Re*, or 1000 *Re*'s.

In Germany.

The *Par* at *Hamburgh* and *Lubeck* is at 32 *s. Flemish* for 1 *l.* Sterling.

These

These are the Principal Places with which *England* does commonly Exchange her Coin.

Of Gain *and* Loss *by Exchange.*

In Exchange with *France*, *Italy*, *Spain*, *Portugal*, so much as you agree for below *Par*, is gain'd by each Piece, and what above *Par* is by each Piece lost; for Instance,

In *France* the *Par* is 4 *s.* 6 *d.* Sterling *per* Crown. Now if I agree with him I exchange at 4 *s.* 2 *d.* I gain 4 *d.* *per* Crown; and if at 4 *s.* 10 *d.* I lose as much.

But in the *Netherlands* and *Germany*, so much as you agree for above *Par* is gain'd by each Piece, and what below is lost by each: For Instance,

In the *Nethirlands* the *Par* is 33 *s.* 4 *d.* *per l.* Sterling: Now if I agree with the Person I exchange at 33 *s.* 8 *d.* then I gain 4 *d.* in each *lb.* Sterling; and if at 33 *s.* I lose as much which in a Bill of Exchange of 500 *l.* Sterling amounts to 8 *l.* 6 *s.* 8 *d.* Gain or Loss.

CHAP. XXIV.

Of LOSS *and* GAIN.

I. THIS Rule shews the Merchant how to find what he Gains or Loses by the Sale of his Goods.

II. There are several Gases in this Rule, and all resolv'd by the Golden Rule of 3.

Case 1.

III. Goods bought at one Price, and sold at another; To find what is gain'd or lost by the Sale of all the Goods. Rule

Rule.

Firſt find what is gain'd or loſt in ſelling 1 *lb.* (or Yard, *&c.*) by taking the difference of 1 *lb.* bought, and 1 *lb.* ſold.

Then ſay, As 1 is to the Gain or Loſs in ſelling of 1 *lb.* *&c.* ſo is the given Number of *lbs.* *&c.* to the Gain or Loſs.

Example.

If 1 *lb.* (of any thing) coſt 6 *d.* and be ſold again for 7 *d.* what is gain'd in ſelling 112 *lb.*

Here I firſt ſubtract 6 *d.* from 7 *d.* and there remains 1 *d.* Then ſay,

If 1 *lb.* gain 1 *d.* what will 112 *lb.* gain? Work and I find the Anſwer 9 *s.* 4 *d.*

Caſe 2.

IV. Goods bought at one Price and ſold at another; To find what is gain'd or loſt *per Cent.* [or in laying out 100 *l.*]

Rule.

Find what is gain'd or loſt in ſelling 1 *lb.* *&c.* as in the firſt Caſe. Then ſay, As the Price of that 1 *lb.* *&c.* coſt, is to the Gain or Loſs in ſelling 1 *lb.* *&c.* ſo is 100 *lb.* to the Gain or Loſs ſought.

Example.

If 1 *lb.* (of any thing) coſt 18 *d.* and be ſold again for 21 *d.* what is gain'd *per Cent.*

Firſt, I ſubtract 18 *d.* from 21 *d.* and there remains 3 *d.* Then I ſay,

If 18 *d.* gain 3 *d.* what ſhall 100 *l.* gain? work and I have 16 *l.* 13 *s.* 4 *d.* for Anſwer.

Caſe 3.

V. Goods bought at a Price; To find at what Price it muſt be ſold again, to gain or loſe ſo much *per Cent.*

Rule

Rule.

Say, As 100 *l.* is to the Price that 1 *lb. &c.* coſts, ſo is 100 *l.* with the Gain added (or Loſs ſubtracted) to the Anſwer; *viz.* (that is to ſay) the Price that 1 *lb. &c.* may be ſold at, to gain or loſe ſo much.

Example.

If 1 *l.* (of any thing) coſt 10 *s.* how muſt it be ſold to gain 10 *l. per Cent.*? Say,

If 100 *l.* give 10 *s.* what ſhall 110 *l.* give? Multiply and divide, and the Anſwer will be found to be 11 *s.* a Pound.

Caſe 4.

VI. Goods ſold at a Price to gain or loſe ſo much *per Cent.* To find what the Goods coſt.

Rule.

Say, As 100 *l.* with the Gain added (or Loſs ſubtracted) is to 100 *l.* ſo is the Price that 1 *lb. &c.* is ſold for, to the Price that 1 *lb. &c.* coſt.

Example.

If 1 *lb.* (of any thing) be ſold for 11 *s.* gaining 10 *l. per Cent.* what did coſt the Pound? I ſay,

If 110 *l.* give 100 *l.* what will 11 *s.* give? *Anſwer*, 10 *s.*

Caſe 5.

VII. Goods ſold at ſuch a Price, and ſo much gain'd or loſt *per Cent.* To find what muſt be gain'd or loſt *per Cent.* when they are ſold at another Price?

Rule.

Say, As the firſt Price is to 100 *l.* with the Gains added, or Loſs ſubtracted, ſo is the other Price to 100 *l.* with the Gains added or Loſs ſubtracted:

tracted: Therefore the Difference betwixt 100 *l.* and the 4th Term thus found is the Answer.

Example.

If I sell Cloth for 10 Shillings a Yard, and gain 10 Pound *per Cent.* what shall I gain if I sell it for 11 Shillings a Yard? Say,

If 10 *s.* give 110 *l.* what will 11 *s.* give? Work and you have 121 Pound, from which subtract 100 Pound, and there remains 21 Pound, the Gain requir'd.

Case 6.

Goods bought at one Price and sold at another upon Time (suppose 2 Months) To know what is gain'd *per Cent.* for 12 Months at that rate?

Example.

VIII. If 1 Pound (of any thing) cost me 2 Shillings and 4 Pence, and I sell the same again for 2 Shillings and 8 Pence, to be paid at the end of 2 Months, I demand what is gain'd *per Cent.* in 12 Months?

I first subtract 2 Shillings and 4 Pence from 2 Shillings and 8 Pence, and there remains 4 Pence: Then I say,

If 2 Shillings and 4 Pence gain 4 Pence, what shall 100 *l.* gain: Multiply and divide, and I have 3 Pound, 11 Shillings and 5 Pence: Again, I say, If 2 Months gain 3 Pound, 11 Shillings and 5 Pence, what shall 12 Months gain? I work, and find 21 Pound, 8 Shillings and 6 Pence, which is gain'd in 12 Months at that rate.

Case 7.

IX Goods bought at one Price, ready Money; To know for what I shall sell the same again to be paid at such a time, (suppose 2 Months) to gain so much *per Cent.* for 12 Months?

Example

Example.

If 1 Pound (of any thing) cost me 2 Shillings and 4 Pence, ready Money, at what Price shall I sell the same again, to be paid at the end of 2 Months, so as to gain 24 Pound *per Cent.* for 12 Months? First, I say,

If 12 Months gain 24 Pound, what will 2 Months gain? In working I find 4 Pound: Then I say,

If 100 Pound give 104 Pound, what shall 2 Shillings and 4 Pence give? *Answer*, 2 Shillings and 5 Pence, *&c.* which is the Price it must be sold for to gain 24 Pound *per Cent.* for 12 Months.

CHAP. XXV.

Of INTEREST and REBATE.

I. WHEN one Man lends Money to another for a Time, upon condition that he pay him so much *per Cent. per Annum*, for the Use of it: Such Money paid for the Use of it, is call'd the *Use*, *Loan*, or *Interest*, and the Money lent is call'd the Principal; and so much as is allow'd *per Cent. per Annum* [that is, for the Use of 100 Pound for a Year] is call'd the Rate. If at the Years end the Principal be not paid, and the Interest do not become a part of the Principal, (but is paid yearly) then it is call'd *Simple Interest*: But if neither the Principal nor Interest be paid, but at the Years end the Interest becomes a part of the Principal, then it is call'd *Compound Interest*, or *Interest upon Interest*.

II. To find the Simple Interest of any Sum of Money, at any Rate, for any time given.

The Rule is,

As 100 Pound is to the Rate, so is the Principal to the Interest for one Year: Then for any other time, say by the Golden Rule,

As	1 Year, or 12 Months, or 365 Days,	is to the Interest for one Year, so is the given Time in	Years, Months, Days,	to the Interest requir'd for the Time given.

Or else work the Interest for the given Time over or under one Year, by Practice.

Example 1.

What will the Interest of 2275 *l.* 11 *s.* 3 *d.* come to in a Year, at 6 *l. per Cent.* State the Question thus,

l.		*l.*		*l.*	*s.*	*d.*	
If 100	give	6	what will	2275	11	3	give?
						6	

	1|00)			
l.	136|53	7	6	
	20			
s.	10|67			
	12			
d.	8|10			

l. *s.* *d.*
Facit 136 10 8 $\frac{10}{100}$

Here 2275 Pounds, 11 Shillings and 3 Pence, (the Principal) is multiply'd by 6 Pound, (the Rate) by the Method formerly taught, and the Product

Product is divided by 100, by cutting off 2 Figures. The Remainder 53 Pound is multiply'd by 20, taking in 7 (the odd Shillings) makes 1067 Shillings, which is divided again by 100, as before, and the Remainder 67 is multiply'd by 12, taking in 3 (the odd Pence) and divided as before.

Example 2.

What is the Simple Intereſt of 550 Pound, 10 Shillings, for 3 Years 9 Months, at 6 Pound *per Cent. per Annum*?

```
    l.      l.           l.   s.
If 100 give 6 what ſhall 550  10 give?
                               6
           ----------------------
     1|00) l. 33|03  00
                |20
           ----------------------
         s.    0|60
                |12
           ----------------------
         d.    7|20
```

Then ſay,

If 12 Months give 33 *l.* 00 *s.* 07 *d.* what will 3 Years, 8 Months give? Work and you will find 123 *l.* 17 *s.* 02 *d.* $\frac{1}{4}$ for Anſwer: Or by Practice thus,

```
Months,      l.  s.  d.
  6      2) 33  00  07  the Int. found for 1 Year.
  3      4) Mult. by 3  the Number of Years.
 ----
 9 Mo.      ----------
            99  01  09  the Intereſt for 3 Years.
            16  10  03 ½  for 6 Months.
             8  05  01 ¾  for 3 Months.
            ------------
```

Anſwer, 123 17 02 $\frac{1}{4}$ the Intereſt of 550 *l.* 10 *s.* for 3 Years, 9 Months, at 6 *l. per Cent. per Annum.*

Example 3.

Unto how much comes the Simple Interest of 248 *l.* 15 *s.* for 8 Months, at 7 *l. per Cent. per Annum*?

	l.		*l.*		*l.*	*s.*	
If	1|00	give	7	what will	248	15	give?
						7	

Mo.		*l.*	*s.*	*d.*
6	2)	17	08	03
2	6			
—		8	14	01 $\frac{1}{2}$
8		2	18	00 $\frac{1}{4}$
Answer,		11	12	01 $\frac{3}{4}$

l.	17	41	05
		20	
s.	8	25	
		12	
d.	3	00	

III. The Way us'd by Bankers for casting up Interest, is generally by Days, thus,

They bring the Principal into Pence, and multiply it by the Days it is out at Interest, and divide by 6083, for 6 *per Cent.* and by 7300 for 5 *per Cent.* (which are the Days of a Year multiply'd by 100, and divided by the Rate of Interest.)

Example

Example 1.

275 *l.* 11 *s.* 3 *d.* at Interest 70 Days, at 6 *l.* *per Cent.*

```
         l.  s. d.
        275  11 3
         20
       ------
        5511 s.
          12
       ------
       66135
          70
      -------   12)
6083) 4629450 (761 Pence.
      42581     ----
      -------   6|3 s.  5 d.
       37135    --------
       36498  l. 3 3 s.  5 d.
       -----
        6370
        6083
       -----          l. s. d.
         287  Facit   3  3  5
```

Example 2.

What is the Interest of 472 *l.* 12 *s.* 06 *d.* for 220 Days, at 5 *per Cent.*

```
                 472 l. 12 s. 06 d.
                  20
                 ------
                 9452 s.
                   12
                 ------
                113030
                   220
                 ------
               2260600
               226060
               -------        12)
     73|00)   248666|00  (3392 Pence.
              219:::        ------
              -----          28|2 s. 8 d.
               286::        ------
               219::      l. 14 2 s. 8 d.
               -----
               676:   Facit 14 l. 2 s. 8 d.
               657:
               -----
                196
                146
               -----
                 50
```

Of Compound-Interest.

IV. What Compound-Interest is has been shew'd above, in Sect. 1. of this Chapter. Now,

To find what any Sum of Money will be increas'd to (being put out to Interest) in any Number of Years, and at any Rate *per Cent.* reckoning Compound Interest.

The Rule is,

Multiply the Principal by the Rate, and divide the Product by 100, and to the Quotient add the Principal,

Principal, ſo you have the Increaſe the firſt Year, which is the Principal for the ſecond Year, with which work as before, and you have the Increaſe the ſecond Year. Do thus for all the Years propos'd, as in the following Example.

What will 225 *l.* amount to in 4 Years, at 5 *l. per Cent.* Compound-Intereſt? Say,

l. *l.* *l.* Multiplyers

If 100 give 5 what will 225 give —— 5

		225		5
		11	25	
Firſt Year,	*l.*	236	25	5
		11	8125	
Second Year,	*l.*	248	0625	5
		12	4031	
Third Year,	*l.*	260	4656	5
		13	0232	
Fourth Year,	*l.*	273	4888	20
	s.	9	7760	12
	d.	9	3120	4
	q.	1	2480	

Facit 273 *l.* 09 *s.* 09 *d.* 1 *q.*

Here I multiply continually by 5, (ſetting the Product 2 Places to the Right, that the Pounds may ſtand right for Addition) and divide by 100, which is done by cutting off 2 Figures; and after the ſecond Multiplication by not ſetting down the 2 firſt Figures of the Product, to abridge the Work of Multiplication, which would elſe be very large: After the laſt Year I multiply the four Figures cut off by 20, 12, and 4, which brings the Remainder into Shillings, Pence and Farthings.

Of Rebate or Discount.

V. *Rebate* or *Discount* is when Money is due at the end of a certain Time, and the Debtor agree with the Creditor, to pay him ready Money, if he will allow him so much (as they agree for) *per Cent. per Annum*, in consideration of his receiving his Money before it be due: I say, this Allowance is call'd Rebate or Discount, and the Creditor must receive so much ready Money as being put out to Use (at the Rate of Discount agreed on, and till the Time it was due) it may amount to the just Sum that would be then due: Now,

To find the present worth of any Sum of Money, due at the end of any time to come, allowing Discount or Rebate at any Rate (propos'd) Simple-Interest.

The Rule is,

As $\left\{\begin{array}{l}\text{1 Year, or}\\ \text{12 Months, or}\\ \text{365 Days,}\end{array}\right\}$ is to the Rate propos'd,

so is the Time propos'd to a 4th. Then, As 100 *l.* added to the 4th (now found, is to 100 *l.* so is the given Sum to its present Worth.

Example.

What present Money will satisfy a Debt of 240 *l.* due at the end of 4 Years yet to come, Discount or Rebate being allow'd at the Rate of 5 *l. per Cent. per Annum.* Answer, 200 *l.* Thus,

If 1 Year give 5 *l.* what shall 4 Years give? Work and you have 20 *l.* Then,

If 120 *l.* proceed from 100 *l.* what will 240 *l.* proceed from; multiply and divide, and you will find 200 *l.* and so much will satisfy the Debt.

CHAP.

CHAP. XXVI.

Of EXTRACTION of ROOTS.

I. I Shall here mention only the Square and Cube Root.

II. The Square-Root of a Number, is a Number that being ſquar'd (or multiply'd by its ſelf) produces the given Number. Thus the Square-Root of 144 is 12. Now,

III. To Extract the Square Root of any given Number,

The Rules are,

1. Point the given Number thus; make a Point over every 2d Figure, beginning at Units: The Figures thus ſeparated are call'd Points, and ſo many Points as there are in the given Number, ſo many Figures ſhall be in the Root.

Example.

What is the Square-Root of 54756?

2. The Numbers are pointed and diſpos'd for Work, by drawing a crooked Line on the right Hand of the given Number, behind which to place the Root thus.

$\dot{5}4\dot{7}5\dot{6}($

 3. Having

Root,	Square,
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81

3. Having learn'd by Heart (from the Table in the Margin) the Square of the 9 Digits, take the greateſt Square that you can in the firſt Point next the Left Hand, and ſubtract it from the Point, ſetting the Root in the Quotient, and the Remainder under the Point, thus,

```
.  .  .
54756 (2
4
―
1
```

4. To the Remainder bring down the next Point, and annex it thereto on the Right Hand: This is call'd the Reſolvend, thus.

```
.  .  .
54756 (2
4 :
―
147 Reſolvend.
```

5. Double the Quotient, and place it on the Left Hand of the Reſolvend, behind a Line, which call the Diviſor.

```
   .  .  .
   54756 (2
   4 :
   ―
4) 147 Reſolvend.
```

6. Seek how often this Diviſor is contain'd in all the Figures of the Reſolvend, except the laſt towards the Right Hand: Set the Anſwer in the Quotient, and alſo on the Right Hand of the Diviſor, thus,

```
                .  .  .
                54756 (23
                4 :
                ―
Diviſor 43) 147 Reſolvend.
```

7. Then

7. Then multiply the Divisor with the Figure annexed, by the Figure last put in the Quotient, and subtract the Product from the Resolvend, setting the Remainder under it, thus.

```
              54756 (23
              4 :
          ----------
Divisor  43)  147 Resolvend.
              129
          ----------
               18
```

8. To this Remainder bring down the next Point for a new Resolvend, and proceed therewith as with the first Remainder in the 4th Rule, repeating the Work of the 5th, 6th and 7th Rule, thus.

```
                 .  .  .
                54756 (234
                4 : :
             -----------
Divisor,   43)  147 Resolvend.
            3)  129 :
             -----------
Divisor, 464)   1856 Resolvend.
           4)   1856
             -----------
                0000
```

Note 1. Each Figure put in the Quotient being placed by the 6th Rule, and also under the last Figure of the Divisor for a Multiplier, (as is done in this Example) their Sum makes the next Divisor, which saves doubling the Quotient.

Note 2. If any thing remain at the last, make it the Numerator of a Fraction, whose Denominator

nator must be the doubled Root increas'd by a Unit: This Fraction joyn'd with the Root before found, gives you the nearest Square-Root to that third Number.

The Extraction of the Cube-Root.

IV. The Cube-Root of a Number is a Number that being Cubed (or multiply'd by it self, and that Product again by the first Number) shall produce the given Number. Thus the Cube-Root of 1728 is 12, for 12 multiply'd by 12, is 144, and that multiply'd again by 12 is 1728. Now,

V. To Extract the Cube-Root of any given Number; The Rules are

(1) Point the given Number, by putting a Point (or Prick) over every 3d Figure, beginning at Units. The Figures thus separated are call'd Points, and so many Points as there are, so many Figures shall be in the Root.

Example.

Extract the Cube-Root of 12167.
The Numbers are prepar'd for Work thus.

$$\dot{1}2\dot{1}67\ ($$

Root,	Cube,
1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729

(2) Having learn'd by Heart (from the Table in the Margin) the Cubes of the 9 Digits, subtract the greatest Cube you can out of the first Point, thus.

$$\begin{array}{l} \dot{1}2\dot{1}67\ (2 \\ \ \ 8 \\ \hline \ \ 4 \end{array}$$

(3) To

(3) To the Remainder bring down the next Point (as in Extracting the Square-Root) and call this the Resolvend. Thus,

```
 . .
12167 (2
 8   :
-----
 4167 Resolvend.
```

(4) Square the Quotient, and multiply the Product by 3, setting it under the Resolvend, so as Units may stand under the Hundreds: Also multiply the Quotient by 3, and set it under the Resolvend, so as Units may stand under Tens: Then add together the Tripl'd Square of the Quotient, and the Tripl'd Quotient; their Sums shall be the Divisor, Thus,

```
                  . .
                 12167 (2
                  8.
                 -----
                  4167 Resolvend.
                 -----
Tripl'd Square,  1200 } add
Tripl'd Root,      60 }
                 -----
                 1260 Divisor.
```

(5) Seek how often the Quotient is contain'd in the Resolvend, and put the Answer in the Quotient. Then multiply the Tripl'd Square by the Figure last put in the Quotient, and set the Product under the Divisor, that Units may stand under Hundreds: Also square the Figure last put in the Quotient, and by it multiply the Tripl'd Quotient,

Quotient, and set it down so as Units may answer Tens in the Divisor. And lastly, Cube that Figure, and set it down so as Units may answer Units.

(6) Add these 3 Numbers into one Sum, which call the Subtrahend.

(7) Subtract the Subtrahend from the Resolvend, setting down the Remainder thus,

	$\dot{1}21\dot{6}7$	(23 The Cube-Root.
	8 :	
	4167	Resolvend.
Tripl'd Square,	1200	add
Tripl'd Root,	60	
	1260	Divisor.
Tripl'd Square mult.	3600	by 3.
Tripl'd Root mult.	540	by (9) the Square of 3.
Cube of 3	27	
	4167	Subtrahend.
	0000	Remainder.

(8) To this Remainder bring down the next Point for a new Resolvend, with which proceed as before, repeating the Work of the 4, 5, 6, and 7th Rules till the Extraction be finish'd. But in this Example there are no more Points to bring down, and so the Work is done, and the Cube-Root is found to be 23.

VI. To remember the Rule, take the following Verses.

Point

Point Thirds, Subtract the Cube, set Root in Quote,
Draw down the 2d Point, and of this note,
It is the first Resolvend. under write
The whole Quote, squar'd and tripl'd, in such Site,
That Ones do Answer Hundreds ; also then
Write tripl'd Root that Ones be under Tens ;
These Triples add, and 'twill Divisor be,
Whence 2d Figure in the Quote you'll see.
Then to be added, for Subtrahend, are
Three Things, the Multiply of Triple Square :
By that same Figure it's Square also take
To multiply the Triple Root, 'twill make
The 2d Thing ; and with its Cube, and so
These add, subtract, you have no more to do.

CHAP. XXVII.

Of Measuring of SUPERFICIES *and* SOLIDS.

I. SUperficial (or Flat) Measure, is the measuring of Superficies [or Outsides] of Things, without any Respect to their Thickness, as in measuring of Board, Glass, Wainscot, Painting, and the like. And here you must know, that 144 Square Inches make a Square-Foot of Superficial Measure, 9 Square-Feet make a Yard Square, and 100 Square Feet is a Square ; 272 $\frac{1}{4}$ Square-Feet is a Square-Perch, and 160 Square-Perches an Acre this known.

II. The *General Rule* is, Multiply the Length by the Breadth, the Product is the *Content* in such Measures as the Dimensions are given in.

Example

Example 1.

A Board of 8 Foot long and 15 Inches broad, how many Square-Feet?

	8	Foot long,
Multiply'd by	12	Inches in a Foot.
Makes	96	Inches long, which
Multiply'd by	15	Inches, the Breadth
	480	makes 1440 Square-Inches,
	96	which divided by 144, (the Square-Inches in a
144)	1440 (10	Foot) gives 10 Foot for
	144	Answer.
	0000	

III. But an easier way to measure Board, Glass, Sawyer's Work, *&c.* whose Content is requir'd in Feet) is to count the Breadth in Inches for so many Pence ($\frac{1}{4}$ of an Inch a Farthing, $\frac{1}{2}$ an Inch a halfpenny, *&c.*) which multiply by the Length in Feet, and the Product in Shillings is the Content in Feet. Thus in the foregoing Example, for 15 Inches I count 15 *d.* or 1 *s.* 3 *d.* Then I say, 8 three-pences is 2 *s.* and 8 *s.* is 8 *s.* which with the 2 *s.* from the Pence is 10 *s.* the Content in Feet, as before.

Example 2.

A Glazier has done a Pane of Glass a Foot 9 Inches and a half broad, and 5 Foot and a half high.

For

F. In.	*s.*	*d.*	*q.*	
For 2 9 ½ count	2	9	2	
			5 ½	
	13	11	2	add
	1	04	3	add
	15	04	1	

Here I say, 5 times 2 *q.* is 2 *d.* ½, then 5 times 9 *d.* is 45 *d.* and 2 *d.* is 47 *d.* or 3 *s.* 11 *d.* then 5 times 2 *s.* is 10, and 3 is 13, then ½ 2 *s.* is 1 *s.* ½ 9 *d.* is 4 *d.* 1 *d.* (or 4 *q.*) remains: Then ½ 6 *q.* is 3 *q.* the Sum is 15 *s.* 4 *d.* 1 *q.* or 15 Foot, 4 Inches and one quarter.

Note, Glazier's Inch (in Superficial Measure) is 1 Foot long, and 1 Inch broad.

Glaziers Work is the most difficult to measure of all others, because they take their Dimensions to the Nicety of a quarter of an Inch; therefore I shall give you another Example of it.

A Pane of Glass, 4 Foot 6 Inches long, and 2 Foot 4 Inches and a half broad.

	s.	*d.*	*q.*	
	2	04	2	
		4 F. 6 Inches.		
Product by the Inches	14	03	0	that
is	1	02	1	added.
Product by the Feet	9	06	0	added.
Sum	10	08	1	

Here, in multiplying by the Inches, for every Shilling I count a Penny, and for every 3d a Farthing.

Ex-

Example 4.

A Joyner has Wainſcotted a Room 44 Foot in Compaſs, and 7 Foot high, How many Square Yards of Wainſcotting is in that Room? *Anſwer*, 34 Yards, 2 Foot. See the Work.

	44	Foot in Compaſs.
Multiply'd by	7	Foot the Height, the Product is 308, which divided by 9 (the Square Feet in a Yard) gives 34 Yards, and 2 Foot over.
9)	308	
Yards	34 (2 F.)	

IV. To meaſure a Circle; multiply half the Diameter [or Breadth] by half the Circumference [or Compaſs] the Product is the Content. Otherwiſe, multiply the Diameter [or Breadth] in its ſelf, and the Product by 11; divide this laſt Product by 14, the Quotient is the Area or Content.

V. *For the Superficies of Round, or Square Pillars*, multiply the Circumference by the Length: This is of Uſe in meaſuring Painters Work; we neglect the Baſes, becauſe they never paint them.

VI. *For Globes*, multiply the Diameter by the Circumference, the Product is the Superficial Content. This is uſeful alſo to Painters.

VII. I come now to ſpeak of Solid Meaſure, ſuch as Timber, Stone, *&c.* and here you muſt know, that

VIII. A Cube is a Figure like a Dye of ſix equal Sides; and that a Cube (or Solid) Foot is *ſuch* a Figure, each Side being a Foot long, and a Foot broad. Now moſt things are meaſur'd by the Cubick or Solid Foot, which contains 1728 ſuch Solid Inches. This being known

IX. *The*

IX. *The General Rule is,* Multiply the Breadth by the Thickneſs, and the Product by the Length; this laſt Product is the Content, in ſuch Meaſures as the Dimenſions were given in; which if it were Inches, then you have the Content in Inches, which you muſt divide by 1728, (the Inches in a Foot) and you have the Content in Feet.

Example 1.

A piece of Timber, 9 Inches broad, 4 Inches thick, and 16 Foot long: How many Feet doth it contain? *Anſwer,* 4 Foot. See the Work.

	16	Foot long,
Multiply'd by	12	Inches in a Foot,
Makes	192	Inches, the Length, which
Multiply'd by	9	Inches, the Breadth,
Makes	1728	which multiply'd
by	4	Inches, the Thickneſs,

1728) 6912 (4 makes 6912, which divided by 1728, the Quotient is 4, and ſo many Feet are in that Piece of Timber.
6912
0000

X. But becauſe (in meaſuring of Timber) the Breadth and Thickneſs are generally given in Inches, and the Length in Feet, therefore it may be meaſur'd more eaſily by this Rule,

Multiply the Breadth in Inches by the Thickneſs in Inches, and the Product by the Length in Feet; and divide this laſt Product by 144, the Quotient is the Content in Feet.

Thus

Thus the foregoing Example being repeated to shew the difference betwixt this way and that,

9 Inches, the Breadth,
Multiply'd by 4 Inches, the Thickness,

Makes 36 which multiply'd
by 16 Foot, the Length,

216
36

144) 576 (4
576

000

makes 576, which divided by 144, gives 4 Foot, as before.

Note, Tho' these ways give the true Content of any piece of Square Timber, yet the Custom is, to add the Breadth and Thickness together, (if they are unequal) and take half their Sum for the true Square; but that way is very erroneous, and always gives the Content *too much*; and the greater the difference in the Sides, the greater is the Error; nevertheless, Custom has made this way currant.

XI. For Round Timber, *&c.* The general Custom is, to gird it with a Line, and take a quarter of the Compass for the true Square. Thus, if a piece of Timber be 44 Inches about, they measure it as if it were 10 Inches Square: But this way is also very erroneous (always giving the Content about a fifth part too little) yet this way is us'd by all Measurers, and therefore I omit the true way, as being seldom or never us'd.

XII. To find how many Inches in Length make a Foot of Square Timber.

Mul-

Multiply the Breadth in Inches by the Thickneſs in Inches, and by the Product divide 1728, the Quotient is the Anſwer.

Example.

A Piece of Timber, 6 Inches Square; How long muſt it be to make a Solid Foot? *Anſwer*, 48 Inches. See the Operation.

```
      6
      6
    ———
    36) 1728 (48 Inches.
         144
        ————
         288
         288
        ————
```

XIII. To find how many Inches in Length will make a Superficial Foot, at any Breadth: Divide 144 by the given Breadth in Inches, the Quotient is the Anſwer.

Example.

How many Inches in Length will make a Superficial Foot, at 6 Inches broad? *Anſwer*, 24. See the Operation.

```
    6) 144 (
    ————————
         24 Inches in Length.
```

XIV. To Meaſure Planks.

Planks are meaſur'd by the Superficial Foot; and according to their different Thickneſs, there are *more* or *fewer* Feet allow'd to the Ton, or Load, as in the following

Table

Table of the Number of Feet that make a Load or Ton of Timber, at all the different Sizes (or Thickness) that Planks are commonly cut.

Of Planks in Thickness,	Inch,	F.			
	4	150	make	3	
	3	200	a Load	4	
	2 ½	240	which	4 ⅘	gives the
	2	300	divide	6	Quantity
	1 ½	400	by	8	of Solid Feet
	1	600		12	
	¾	800		16	

Of Planks in Thickness,	Inch	F.			
	4	120	make	3	
	3	160	a Ton,	4	
	2 ½	192	which	4 ⅘	gives the
	2	240	divide	6	Quantity
	2 ½	320	by	8	of Solid Feet.
	1	480		12	
	¾	640		16	

Note, 50 Solid Foot is a Load, and 40 a Ton.

XV. Any Number of Feet of Plank being given; to find how many Load, or Ton, and Feet of Timber.

Rule.

Divide the given Number of Feet by the Number in the 2d Column, (against the given Thickness of the Plank,) the Quotient is Loads, (or Ton;) and if any thing remain, divide it by the Number in the 3d Column, and the Quotient is Feet.

Ex.

Example.

In 7680 Foot of 4 Inch Plank, how many Load and Foot of Timber? *Answer*, 51 Load, 10 Foot. See the Work.

```
15|0) 768|0 (51 Load.
      75
      ----
       18
       15
      ----
    3) 30
   ------
       10 Foot.
```

Laus Deo Gloria.

For the Satisfaction of some Persons, it may not be improper to acquaint the World, That the Author of this Treatise serv'd his Aqprentice-ship with that Celebrated Penman, Mr. *George Shelley*, late of *Warwick-Lane*, now Writing-Master of *Christ-Church* Hospital.

FINIS.